Electrical World

FEBRUARY 7, 1942

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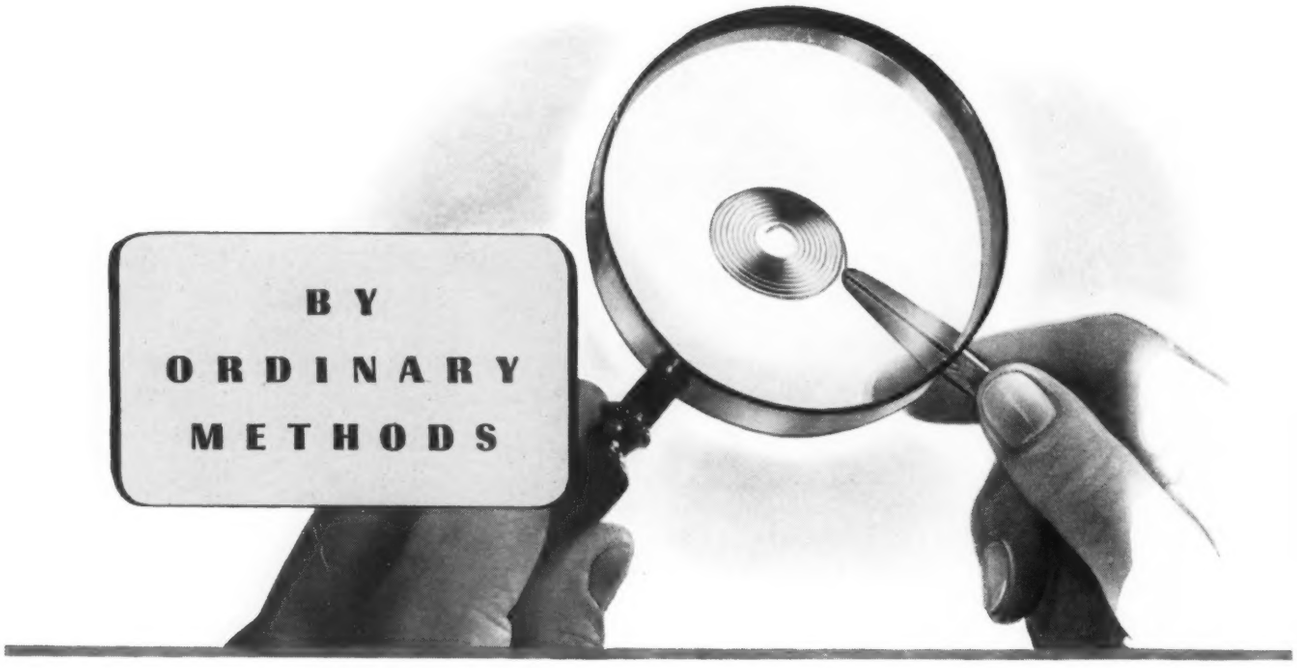
STEAM CAPACITY FOR TVA



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February 7, 1942

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Selling Must Not Stop

Some people in the utility business seemed to have got the idea that because of reductions in appliance manufacture and because of threatened power shortages it was somehow unpatriotic to sell. Nothing could be more wrong.

Utilities need to sell today. They need to sell for two reasons. The first reminds us of the Red Queen's remark to Alice in "Through the Looking Glass," after they had been running as fast as they could and getting nowhere, that "Here you see it takes all the running you can do to keep in the same place."

The utilities must sell the residential load as hard as or harder than ever to keep from going backward. Daylight saving, blackouts, need for economy, more men in the Army and other reasons for residential load mortality are going to be hard to overcome as the supply of new appliances falls off. It can be done, however, if utilities will step up their selling, but in a different way, and that brings us to our second and perhaps more important reason for selling.

Shortages in raw materials are making it necessary for people to learn how to get along with what they have, how to prolong the lives of more and more things. The rubber manufacturers, for instance, are telling customers how to increase the life of tires.

That is a selling job that utilities have before them. How best to use and take care of present equipment. Home service departments, of course, have done a lot of such work, but not with the same compelling urgency. Now it is a must job.

Today's selling will be different. It will be directed not to the sale of a device but of a service—a service that is of immediate value in our war economy.

Is it true that meats shrink less and vegetables lose less of their vitamins with electric cooking? Is it true that there is less food spoilage with electric refrigeration? Is it true that clothes washed and ironed at home with electrical appliances last longer? Is it true that workers' and children's eyes show less strain when the lighting is good?

If all these things are true, then electric utilities have a patriotic duty to help the public to get more out of their appliances and to keep them in repair. That is today's selling. If it will help in our war effort, then sell it.

We must save food and clothing. We must preserve health. As domestic help goes into factories we must preserve the strength of housewives.

There may be fewer appliances to sell, but never was there a bigger selling job to do.

And when this thing is over the utilities will have found a larger place in the hearts of the people. Certainly the utilities will have learned once more to sell what they are in business for —to sell a public service. Selling must not stop.

Watts Bar Steam Design Simple, Direct, Economical

Unit operation of boiler, turbine and transformer gives low fault current, moderate breaker duties and mechanical stresses—Hydro pond supplies condensing water — Common 154 kv. bus for hydro and steam plants

R. A. HOPKINS, *Tennessee Valley Authority, Knoxville, Tenn.*

DESIGNED and built by the Tennessee Valley Authority under pressure of national emergency to supply base energy for defense industries, Watts Bar steam plant, with its initial three and ultimate four 60,000 kw. units, accepts proved designs in all its major equipment and follows the working pattern of the authority's new hydro plants in its main electrical connections. As a permanent steam supplement to a large predominantly hydro electric power system, much of the reserve equipment and special control required in a metropolitan area steam plant is purposely omitted, and the station design is simple, direct and economical.

Unit operation of a boiler, a turbine and a transformer bank directly on the 154-kv. bus is a predominant feature of the design. Each unit has its individual auxiliaries served by individual auxiliary power transformers. Cross-connections between main steam and feedwater systems and between unit auxiliary power buses are provided only for emergency use. The unit idea eliminates generator busing and results in simple design, construction and operation, low main and auxiliary power fault currents and moderate breaker duties and mechanical stresses.

WATTS BAR steam plant output transmitted to 154-kv. hydro plant switchyard for TVA system distribution. Electric controls for steam plant are in the hydro control building

System Connections

About 3,500 ft. downstream from Watts Bar hydro plant on the Tennesee River on level land with favorable foundation conditions, the steam plant is in position to receive low-cost coal by rail, highway or river and condensing water by gravity from Watts Bar reservoir.

The steam plant is connected directly to the hydro plant 154-kv. switchyard through which the five 33,333-kva. hydro generators and the four ultimate 66,667-kva. steam generators connect to four initial and six ultimate 154-kv. transmission lines.

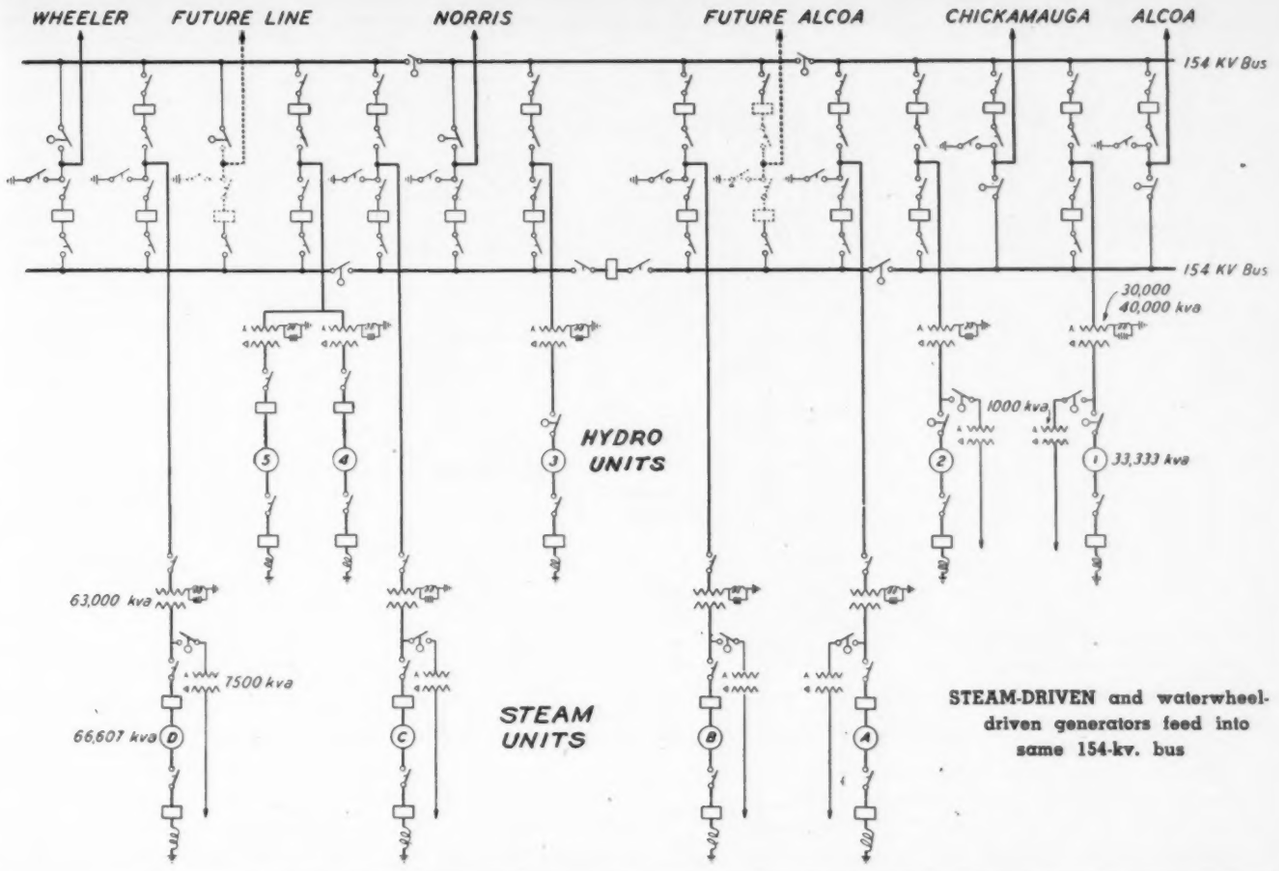
Station Arrangement

Fuel can approach from three sources directly to the storage yard or the bunkers, ash is sluiced into adjacent low-lying areas, condensing water is received from the hydro plant reservoir by conduits directly to the condensers and discharged into the river, and energy will move, in almost a direct line from the coal pile, through the boilers, turbines, generators, transformers and short transmission lines to the hydro station bus. The interior arrangement of equipment is to a considerable extent conventional. The generator coolers, neutral breakers, reactors, excitation cubicles and CO_2 equipment are on an intermediate floor immediately below the generator side of the turbine room. Generator main leads pass through the turbine room wall to the outdoor breakers and transformers. Auxiliary power transformers are in the yard near the delta bus.

Fuel is handled at the rate of 400 tons per hour by a rotary car dumper and track hopper, a belt conveyor system and a crusher plant. Yard storage capacity of 200,000 tons with drag scraper equipment and bunker capacity of 1,200 tons per boiler are provided. All drives and the magnetic material separator are electric with local controls and with the usual interlocks to prevent the "piling up" of coal.

Boilers are rated 600,000 lb. per hour, 900 lb. per square inch, 900 F. The principal boiler auxiliaries are listed in the accompanying table. One spare boiler feed pump is provided for each pair of two boilers. It is arranged to start automatically as a result of low differential pressure across either feedwater regulating valve. Three of the pulverizers for each boiler are required for normal operation and the fourth is for standby at normal load and to assist on overload. One of the two duplex fans per boiler may be used without the other at reduced loads.

Turbines are rated 1,800-r.p.m., 850-lb., 900-deg., 2-in. back pressure. They are single-cylinder, seventeen-stage machines with extractions for



STEAM-DRIVEN and waterwheel-driven generators feed into same 154-kv. bus

four stages of feedwater heating. The direct-driven lubricating oil pumps are supplemented by a motor-driven pump for each turbine used during the starting period when the turbine speed is below the effective speed of the direct-driven pumps. A small a.c. motor-driven pump is provided for lubrication of the bearings when the turbine is being rotated by the motor-driven turning gear and a small d.c. motor-driven pump is provided to protect the bearings during deceleration in case of loss of a.c. source. The other principal turbine auxiliaries are listed in the table. One of the two condensate pumps for each turbine is a spare for the other, but automatically is cut into service on rising hotwell water level.

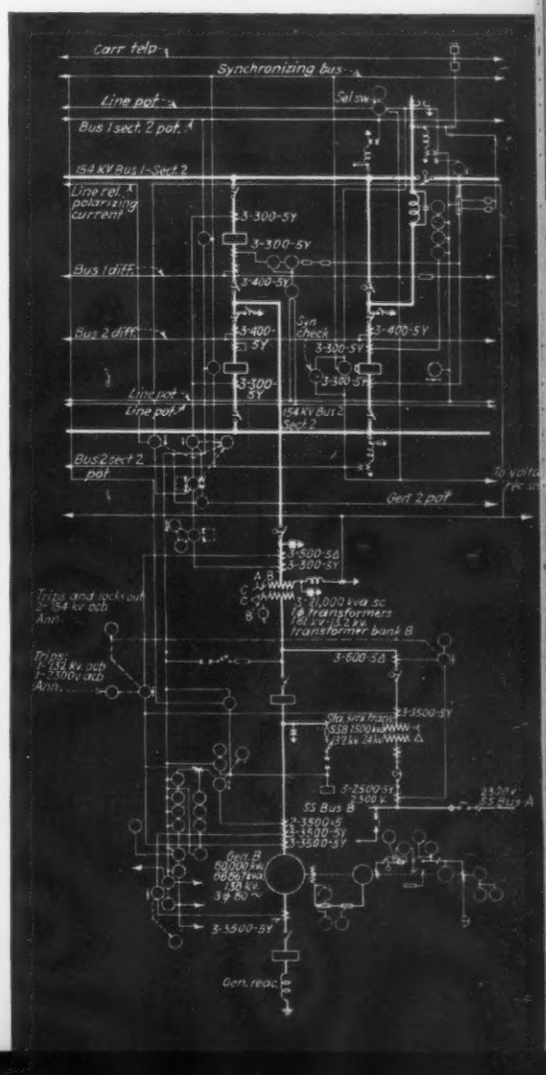
Air-Cooled Generators

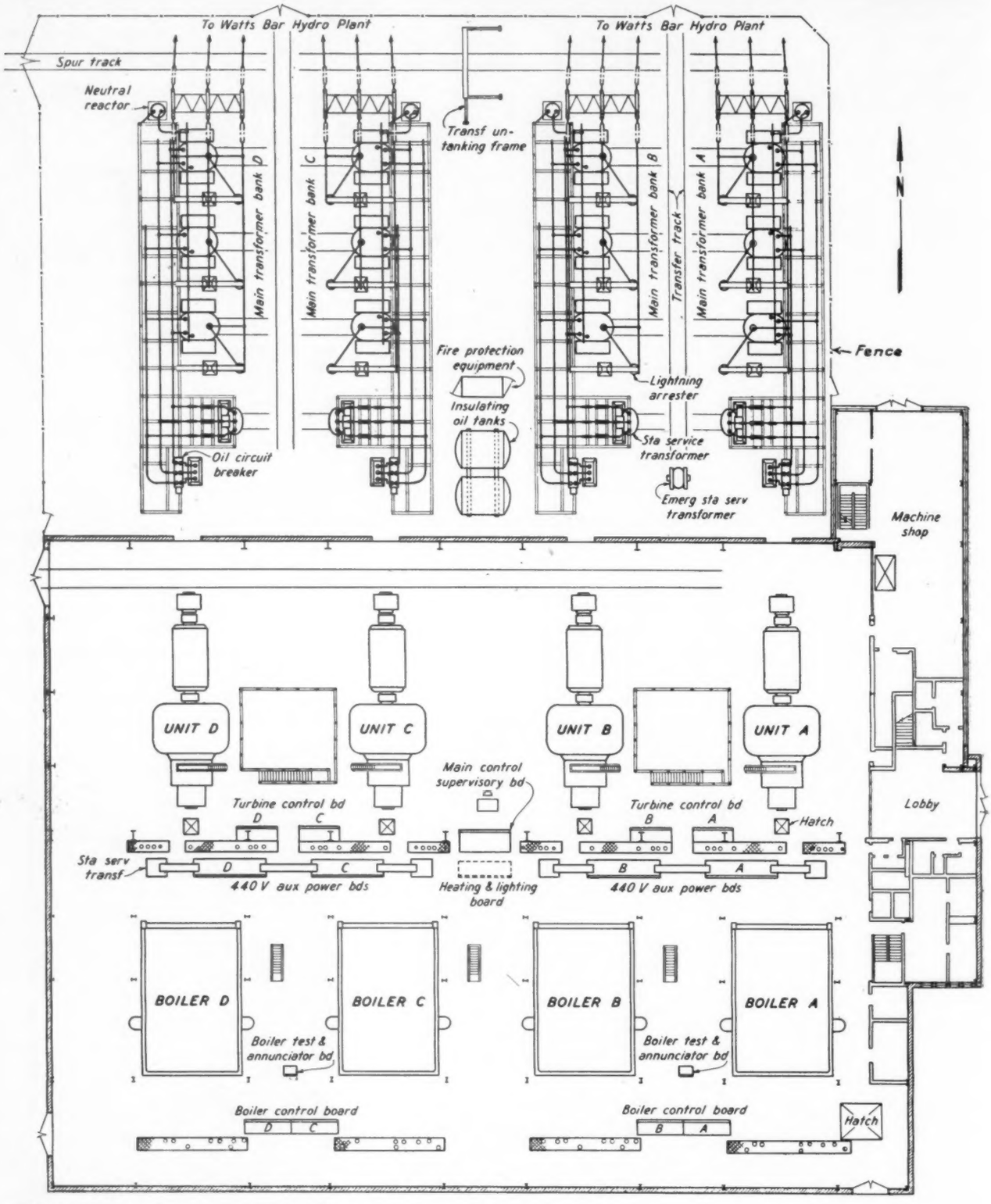
Generators are rated 66,667 kva., 0.9 power factor, 13,800 volts, three phase, 60 cycles and are provided with direct-connected 250-volt main and pilot exciters. The stators have Class B insulation for 100 C. operation and the rotors are designed for 125 C. operation. The machines are of conventional design with inclosed ventilation for generators and exciters and with common water coolers. Air circulation is by means of fans on the rotors. The cooling air from the exciters passes through an air filter before entering the coolers. Each generator neutral is grounded through an individual 0.32-ohm neutral reactor and a breaker. A centralized bank of carbon dioxide cylinders is provided for fire protection of the four ultimate generators with automatic routing valves and timing mechanism for automatic initial and delayed discharges. Spare exciters are not provided.

Step-up transformers are located in the yard just outside the turbine room wall. Each bank is rated 63,000 kva., 55-deg., 13.2/161 kv. and consists of three single-phase units self-cooled with inert gas over the oil. The 161-kv. neutral of each bank is grounded through a 24-ohm reactor. Spare transformers are not provided.

Controls and indications for each boiler are centralized on a vertical steel cubicle-type control board located on the operating floor in the firing aisle. Likewise, controls and indications for each turbine are located on a cubicle-type control board located on the operating floor at the

SINGLE-LINE main diagram for typical steam generator and line





STATION laid out for unit operation. Each boiler in line with turbine

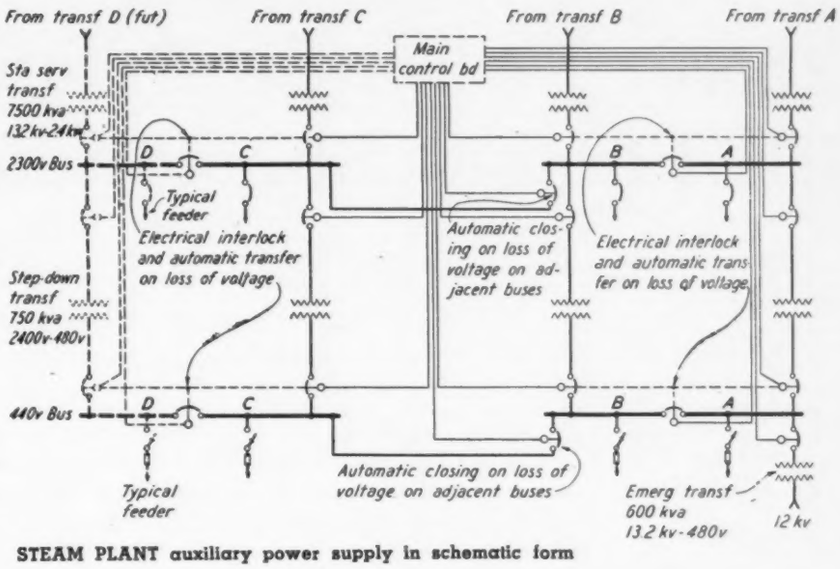
head end of each turbine. These eight control boards for the ultimate four boilers and turbines are further centralized by being grouped between units A and B and between units C and D. Pump controls are grouped on two pump and heater control boards, one for each pair of units, located near the condensers.

A supervisory board of steel cubicle type for the entire station, with significant indicating instruments, most of the recorders, the relays and the controls for the auxiliary power sources and bus sections, is located on the operating floor in line with the turbine boards at the center of the four-unit station. The chief operator has a desk in front of this board. Among the instruments on the turbine boards are vibration amplitude recorders, eccentricity recorders and speedcamshaft-position recorders.

Remote control of the generators is

performed at the main control board of the hydro plant, which also controls the hydro units and the entire switchyard. A steam unit is handled exclusively by the turbine operator in the steam plant during the starting and warming period up to the point of synchronizing. At this point the control room operator takes over, synchronizes, connects to the system and adjusts load and excitation as directed by the system load dispatcher.

A simple turbine signal system is provided between the control room at the hydro plant and the control points in the steam plant. Signals and replies, in addition to being annunciated, are also automatically printed on the station operation recorder in the hydro plant control room. Emergency shut-down push buttons are provided on the boiler and turbine control boards and on the turbine room supervisory board.


From transf D (fut)
From transf C
From transf B
From transf A
Main control bd
Sta serv transf 7500 kva 132 kv-24 kv
2300v Bus
D
C
B
A
Typical feeder
Electrical interlock and automatic transfer on loss of voltage
Automatic closing on loss of voltage on adjacent buses
Electrical interlock and automatic transfer on loss of voltage
Step-down transf 750 kva 2400v-480v
440v Bus
Typical feeder
Automatic closing on loss of voltage on adjacent buses
Emerg transf 600 kva 13.2 kv-480v
12 kv

STEAM PLANT auxiliary power supply in schematic form

Auxiliary Power Connected Loads

(on the basis of the ultimate four units)

All motors are squirrel-cage induction except the rotary car dumper motor, which is slip-ring induction. Motors marked * are 2,200-volt, all others are 440-volt.

Coal Handling		
1 Crusher	200	
1 Storage hoist	200	
1 Conveyor to power house	60	
1 Rotary car dumper	40	
1 Storage conveyor	40	
1 Barge unloading conveyor (future)	40	
1 Car and truck unloading conveyor	30	
3 Car pullers	30	
1 Tail tower drive	20	
15 Miscellaneous motors	60	
Total horsepower	720	
Total kw., including 100-kw. lighting and heating		700
Four Boilers		
4 Normal feed pumps	5,000*	
2 Spare feed pumps	2,500*	
8 Duplex fans	6,400*	
16 Coal pulverizers	3,200*	
2 Ash sluice pumps	250	
2 Ash disposal pumps	150	
4 Distilled water pumps	240	
50 Miscellaneous motors	150	
Total horsepower	17,890	
Total kw.		14,000
Four Turbines		
8 Condensate pumps	1,000*	
4 Lubricating oil pumps	240	
4 Condensate drain pumps	100	
4 Heater pumps	80	
4 Turning gears	60	
30 Miscellaneous motors	120	
Total horsepower	1,600	
Total kw.		1,300
Station Services		
2 Battery chargers	120	
2 Air compressors	100	
4 Sump pumps	60	
1 Elevator	15	
1 Vacuum cleaner	20	
5 Crane motors	175	
3 Raw water pumps	225	
7 Air-conditioning motors	125	
20 Miscellaneous motors	100	
Total horsepower	940	
Total kw., including 300-kw. lighting and heating		1,100

Electrical connections are indicated in accompanying illustrations. The generator main breaker, rated 3,000 amp., 1,000,000 kva., 8 cycles, permits synchronizing at this point instead of at the 154-kv. bus, so that the auxiliaries for a unit may be supplied from the main transformer during the warming period and need not be transferred while synchronizing. The 154-kv. motor-operated disconnect at the steam plant is for disconnecting the transformer during periods when a steam unit is shut down so that the two breakers in the switchyard at the hydro plant can be used for other purposes as required.

The two 1,200-amp., 2,500,000-kva., 8-cycle breakers for each generator and the single breaker and motor-operated disconnect for each line are typical of the switching used at most of the auhtority's new hydro plants. One of the generator breakers may be used as a spare for the other generator breaker or for a line breaker and the two generator breakers may be used as a bus tie. The generator and line circuits are alternated along the bus to avoid excessive power transfer on the bus and so that the bus may be operated split at various sectionalizing points with various amounts of steam and hydro generation on each section.

Main connections from the generators to the transformers have a capacity of 3,000 amp. and consist of two 4-in. copper channels forming a 4x4-in. hollow square section. The conductors are mounted on porcelain insulators and inclosed in a rectangular housing with interphase barriers. Connections from the auxiliary power transformers in the yard back to the 2,300-volt board in the station have a capacity of 2,100 amp. and are of similar design except that two 3-in. copper channels are used.

Auxiliary power, control and lighting wiring in moderate temperature locations is insulated with performance rubber, covered with tough rubber jacket and laid in transite trays or run in exposed steel conduits. All wiring located in areas subject to high ambient temperatures is insulated with varnished cambric and felted asbestos. The control cables connecting the steam plant with the hydro plant are rubber insulated, rubber jacketed and are run below ground in transite ducts inclosed in concrete envelopes.

Switchyard

The 154-kv. buses are of 4½-in. standard galvanized steel pipe with joints and taps welded and zinc sprayed and are supported from the ground by post insulators on light steel bents. The steel structure is of the low type with center take-off, of galvanized latticed steel members. The entire switchyard is protected by an overhead grounding shield extended from the transmission line overhead ground conductors. Lightning arresters are provided near the transformers at the hydro plant and at the steam plant.

Power Design in Defense Plants III—Factory Substations

Lighting and power load densities determine number, size and placing of substations — Comparative advantages of roof and vault locations — Values of capacitors for voltage regulation

By HERMAN WINTE, Albert Kahn Associated Architects & Engineers, Inc., Detroit, Mich.*

DETERMINATION of the size, number and location of factory substations in defense industrial plants is mainly an empirical art. Because of the time element in defense construction electrical systems are frequently laid out before load concentrations are exactly determined. Shifts in the production set-up after the plant is in production and the resulting changes in substation loading also militate against exact evaluation of all variables.

Lighting is practically the only stable and predictable load in factory substations. It ranges from 5 to 6 watts per square foot for incandescent and around 2 watts per square foot for fluorescent systems. Because it is stable, lighting load is the starting point used to guide determination of the number and location of factory substations.

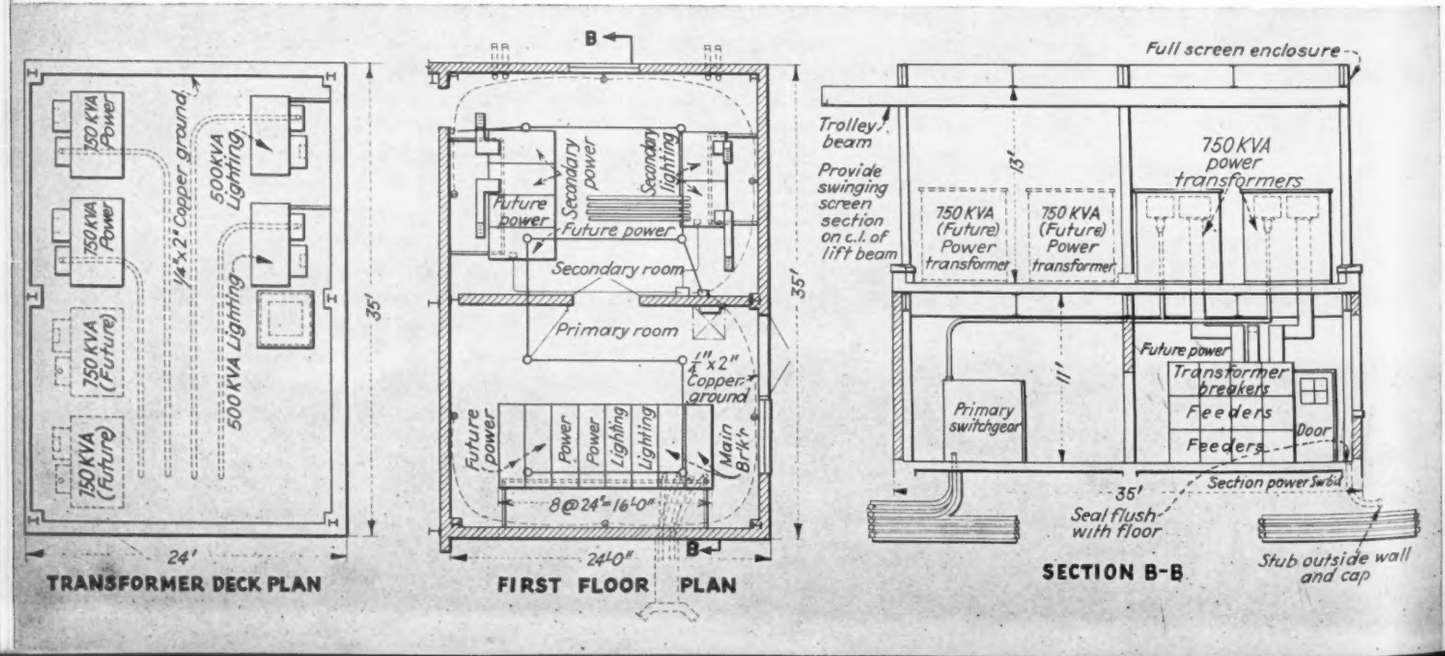
Aside from its desirable lighting characteristics, fluorescent light is popular in defense plants because it permits the maximum area to be served by a transformer of a given size. Lighting feeders are generally restricted in length to 300 ft. as the maximum for good voltage at the lamp—this is an important consideration with fluorescent lamps where lamp voltage is relatively critical. To this 300-ft. limit on lighting feeders is added the restriction of 500 kva. as preferred and 750 kva. as a maximum lighting transformer size at normal rating. Larger kva. ratings require more expensive switchgear of higher interrupting capacity and with the failure of any lighting transformer there is less load for other transformers to carry in an emergency. Lighting transformers are loaded more nearly to full rating than power transformers because of load stability.

Under these conditions it is seen that a substation area 425 ft. square using fluorescent lighting with 2 watts per sq.in. load could be served by a lighting transformer of roughly 375 kva. or well under the 500 kva. maximum. Incandescent lighting with 5 watts average for the same area would require about 900 kva. To keep within 500 kva. size, therefore, more substations would have to be resorted to in order to hold down transformer size.

The area per substation as determined by lighting considerations is subject to adjustment to bring it into conformity with the available investment for substation power transformers and equipment and the degree of interconnection. If a rela-

* Electrical engineer.

TWO-LEVEL roof substation makes for short direct routing of feeder cables from substation to load centers. Transformers on roof have excellent ventilation and can be more heavily loaded than those in vaults



tively few substations are indicated by lighting considerations, large power transformers may be required to supply the usual wattage density of 10-15 watts per sq.ft., and if the secondary mains between two or more substations are interconnected the cost of substation switchgear will increase sharply because of the greater breaker interrupting capacity required. The number of primary feeders and master substation switchgear will, however, be less.

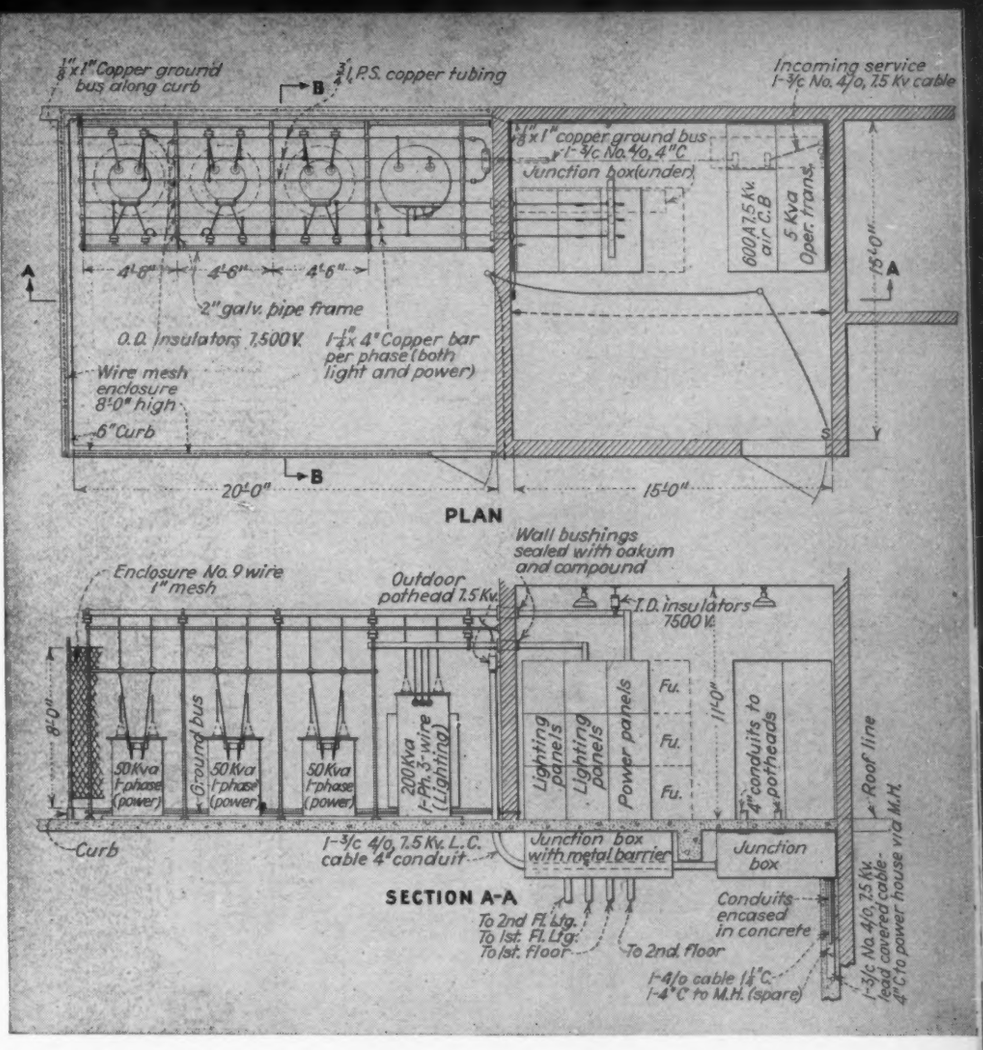
Going to the other extreme, a large number of small factory substations, while reducing the size of transformers and switchgear in each substation, greatly increases the amount of primary distribution cable and also requires a great deal more primary switchgear.

Breaker Limits

Practice is to limit the rating of factory substation transformer secondary breakers to about 50,000 amp. interrupting capacity. Assuming 5 percent transformer impedance and allowing 25 percent extra transformer capacity for growth, aggregate transformer capacity feeding into a single secondary bus is limited to around 1,500-2,000 kva. However, there is provision for interconnection of two or more substation transformers during emergencies. Transformer capacity under these circumstances is reduced by interlocking of certain transformer breakers with tie breakers.

One aircraft plant, for example, standardized on 2,000-kva. power transformers for all factory substations and provided enough breaker interrupting capacity to interrupt a little over the short-circuit capacity of two transformers in parallel. Standardization on 2,000 kva. for all substations regardless of load concentration provided plenty of extra capacity for load growth or unexpected shifts in load from one area to another. It also allows ready interchange of transformers from one substation to another in the event of failure.

Standardization on a single transformer size throughout the plant is common practice. It is much less expensive to operate some transformers overloaded and others underloaded and have the capacity available to meet shifts in load than to calculate loads to a nicety and be forced to shift transformers and switchgear from substation to substation as machines are rearranged. Overloads on certain substations are customarily relieved by relying on interconnections of secondary buses through the breakers at the factory substation or by closing sectionalizing points in low-voltage busbar duct runs between heavily and lightly loaded adjacent substations.



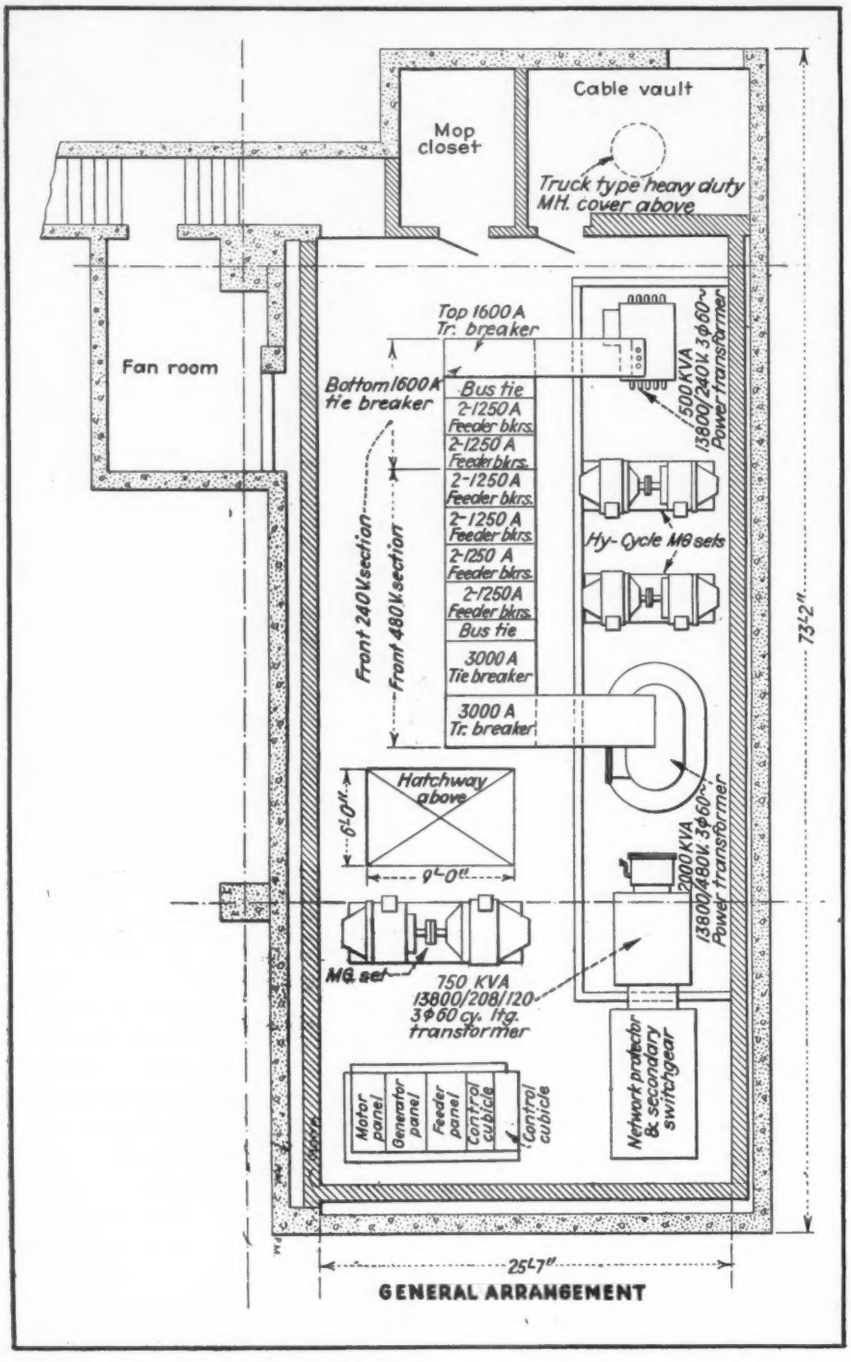
LESS FREQUENTLY USED single level roof substation requires special structure for switchgear; routing of cables is less direct and convenient

Physical Location

Factory substations are uniformly located where they will interfere least with production and where space is the cheapest. This implies location in one of three places—(1) on the roof, (2) in basement vaults or (3) in little used storage areas. Roof substations and basement vaults are most popular. Individual company preferences determine locations. Sabotage and exposure to bombing are recent factors leading many to favor basement vaults.

Roof substations have these advantages: (1) They are less expensive than vaults; (2) ventilation is excellent, outdoor transformers may be more heavily loaded than in vaults; (3) roof space is unusable for production purposes and "rental" charged to electrical department extremely low; (4) connections from substations to distribution centers are short and in one direction—down. Drawbacks to roof substations are: (1) Vulnerable to air attack; (2) they can be used only where roof construction permits and in the absence of heavy crane bays.

Basement vaults have the following advantages: (1) Distribution is simplified since primary feeders can be brought directly into the vaults underground; (2) cable tunnels, connecting substation vaults, simplify secondary interconnection and provide a convenient location for feeder breakers and master panels; (3) power distribution from floor to production machines is free from limitations imposed by cranes and other overhead interferences; (4) they are said to be less vulnerable to air attack than roof substations. Their drawbacks are: (1) Vault construction is much more expensive than roof substation construction; (2)



VAULT substations under production floor are more costly than roof substations, are less vulnerable to bombing and free from cramping effects of cranes and other overhead interferences. Ventilation is a problem, however

ventilation of transformers is a problem; (3) fans and air cleaning equipment are an added expense not necessary with roof substations.

Typical Arrangements

Accompanying drawings show the physical arrangement of roof-mounted substations that were used by a large arsenal and by an aircraft engine plant. In both of these cases transformers for both lighting and power were placed on the roof, with the primary and secondary switchgear directly below. Cables and metal-clad bus are run directly from transformers to switchgear and thence through the floor of the switchroom to the low-voltage distribution system in the production area. Firewalls are usually omitted from the substation switchrooms if voltage is under 7,500 or if air circuit breakers are used.

An automotive plant recently adopted a single level roof substation using outdoor transformers in a woven-wire fence inclosure beside a concrete penthouse that inclosed switchgear. While providing good transformer ventilation, this arrangement is more costly than the two-level substation. Arrangement of transformer primary and secondary leads to switchgear is not as simple or as direct. It was used in this case only because of structural reasons.

Typical of the more recent basement vault designs is the arrangement shown used at a large aircraft plant. Here basement vaults containing transformers and transformer breakers are connected by cable tunnels. Suspended from the tunnel ceiling are four parallel 440-volt buses consisting of three-conductor, 750,000-cir.mil, rubber-insulated cables with a grounded double copper tape wrapping. Tie breakers connecting the 440-volt buses of adjacent tunnels between vaults were located in cable tunnels. Also in the tunnels and tapping the 440-volt buses at intervals are 440-volt secondary feeder breakers and master panels containing fused disconnect switches feeding to distribution panels on the production floor above. Conduit from master panel to distribution panels was run in hollow floor slab.

Lighting transformer and lighting switchgear were located in the vault with the power transformers. Switchgear consisted of standard network protector and secondary tie breakers.

Transformers

In large industrial plants with multiple factory substations three-phase transformer units are predominant. The single-phase transformer bank is restricted to plants served from a single substation or without primary or secondary interconnection between factory substations. Loss of a three-phase transformer under these circumstances means complete or extensive shutdown. The single-phase bank in these very limited instances permits temporary operation with two transformers in open delta.

In the larger plants, with interconnection of secondary mains, single-phase power and lighting banks are no longer necessary for reliability, since in most such plants load of any substation can be carried by others until the transformer is replaced. Space-consuming aspects have placed banks in disfavor. Standardization of

transformer sizes and voltages within individual defense plants today permits ready replacement of faulted units and when considered in conjunction with interconnection eliminates most of the reasons for continuance of single-phase banks.

In one modern tank arsenal, however, where the entire plant load is served from only three factory substations without interconnection, single-phase transformer banks have been used for reliability reasons.

Capacitors

Because load may vary widely over a period of days, some scheme for switching capacitors on and off at factory substations is vital to any installation of capacitors for power-factor corrections.

At two important defense plants 300 kva. of static condensers are being installed at each factory substation in two banks of 150 kva. each. One bank is connected to the system at all times and the second is switched automatically on and off by magnetic contactors controlled by reactive-kva. meters. Provision is also made for installation of 15 kva. of capacitors at each master power and welding panel under manual control. As many or as few of these 15-kva. banks are connected to the system as load conditions require.

Proper coordination of the 150-kva. substations and the 15-kva. capacitor bank at the load is expected to give very good control of power factor. The automatically switched bank is intended to give the coarse adjustment of capacitive reactance, while the small 15-kva. banks provide the necessary fine adjustment to give exact control over a wide range of load conditions.

Where these capacitor installations are used automatic step-type voltage regulators are also installed at the master substation to hold bus voltage constant. Properly coordinated, the capacitors correct power factor and release copper capacity by absorbing wattless component, at the same time raising voltage at the ends of feeders. Voltage regulator reduces the spread between no-load and full-load voltage —giving better regulation. Objective of the capacitor installation is maintenance of power factor at 95 percent at full load and with the voltage regulators to hold a voltage regulation of between 2 and 3 percent.

Utility Prepares for Emergencies

Cambridge Electric organizes its personnel and facilities to guard against air raid damage and provide for rapid recovery of service

THE Cambridge Electric Light Company, serving a diversified residential, commercial and industrial load, across the Charles River from Boston, has organized its staff and plant facilities to guard against damage from air raids and provide for rapid recovery of service should this be temporarily impaired under emergency conditions.

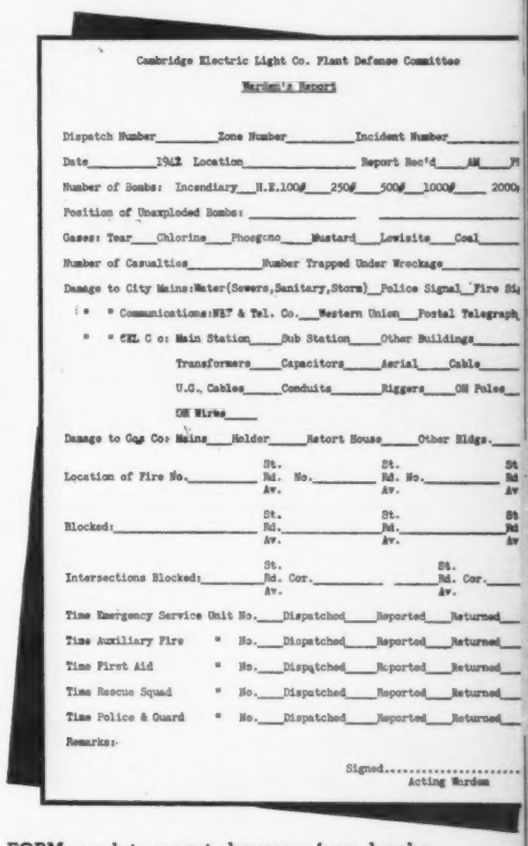
Defense Organization

A defense organization has been set up (see diagram) which reports to the general manager through a chief warden who gives full time to protective measures, having been transferred from construction activities now in abeyance.

The steam and electrical engineering staffs already existed as available branches of the defense set-up, the fire, policing and air raid branches being adapted to the company's needs as the emergency required.

A plant control center has been established on utility property, with C. J. Kewer, chief warden, shown in an accompanying illustration at right and George H. Gowdy, assistant chief warden, at left. This information and control point is manned by two men 24 hours per day, with ample telephone and radio receiving facilities, and is at all times in touch with local air raid information centers, the city control center, district warning center and Army information center.

Protective organization charts, telephone addresses, location of emergency crews, spotters, reports of regional conditions, contact with fire organizations, police (private and public), first-aid facilities and personnel, are maintained. A semaphore card at the top of the telephone line diagram shows air raid conditions by the following colors: Yellow, air raid indicated; blue, air raid probable; red, air raid certain; white, all clear.



Cambridge Electric Light Co. Plant Defense Committee

Warden's Report

Dispatch Number_____Zone Number_____Incident Number_____

Date_____1942 Location_____ Report Rec'd____AM____PM

Number of Bombs: Incendiary__H.E.100#___250#___500#___1000#____ 2000#

Position of Unexploded Bombs: _____ _____

Gases: Tear___Chlorine___Phosgene___Mustard___Lewisite___Coal_____

Number of Casualties_____Number Trapped Under Wreckage_____

Damage to City Mains:Water(Sewers,Sanitary,Storm)__Police Signal__Fire Sig.

" " Communications:NET & Tel. Co.__Western Union__Postal Telegraph

" " CEL C o: Main Station____Sub Station____Other Buildings_____

Transformers____Capacitors_____Aerial____Cable_____

U.G. Cables_____Conduits_____Riggers____OH Poles__

OH Wires____

Damage to Gas Co: Mains___Holder____Retort House____Other Bldgs.____

Location of Fire No._____ St. Rd. Av. No._____ St. Rd. Av. No._____ St. Rd. Av.

Blocked:_____ St. Rd. Av._____ St. Rd. Av._____ St. Rd. Av.

Intersections Blocked:_____ St. Rd. Cor._____ _____ St. Rd. Cor._____ St. Rd. Av.

Time Emergency Service Unit No.____Dispatched____Reported____Returned____

Time Auxiliary Fire " No.____Dispatched____Reported____Returned____

Time First Aid " No.____Dispatched____Reported____Returned____

Time Rescue Squad " No.____Dispatched____Reported____Returned____

Time Police & Guard " No.____Dispatched____Reported____Returned____

Remarks:

Signed.....
Acting Warden

FORM used to report damages from bombs

A siren at the window signals plant employees in the vicinity to go to their prearranged posts in case of emergency. Irving Dwinell of the illuminating engineering staff heads the company's police organization.

A trailer pumping unit made by

PLANT CONTROL center for emergency operations

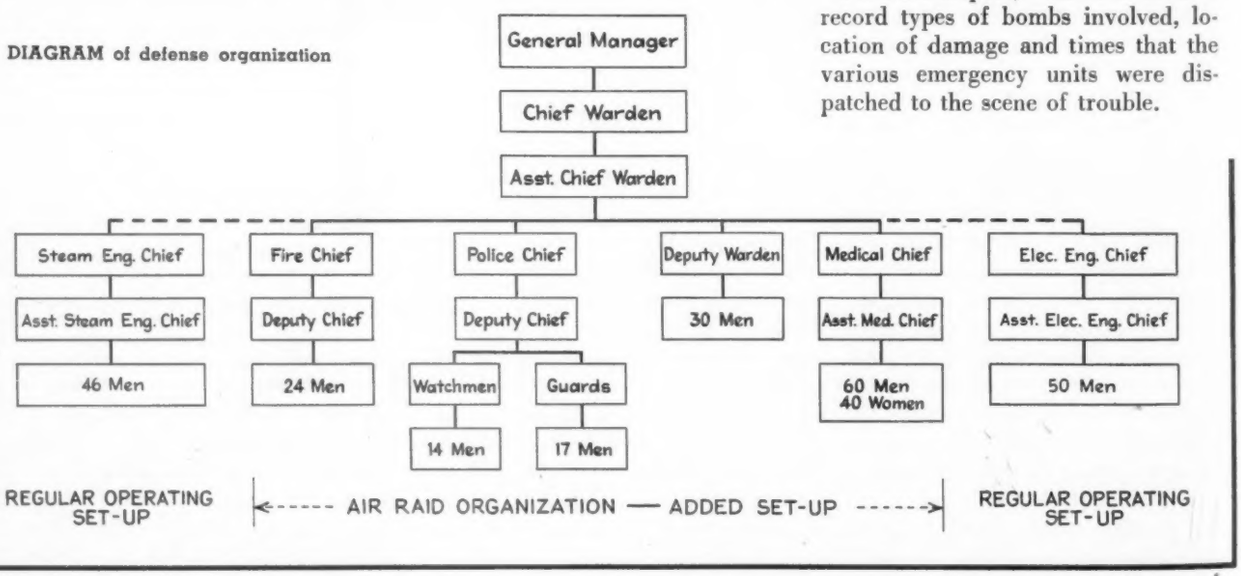
TRAILER pumping unit, hauled by company trucks

the Hale Fire Pump Company, Inc., Conshohocken, Pa., has been installed in an emergency fire station on the property of the company. This pumper has a capacity of 500 g.p.m. and is equipped with 1,200 ft. of hose, two fog nozzles, gas masks, extension ladders, extinguishers, axes and other necessities.

Six of the company's trucks are equipped to haul this unit and a force of nineteen men, including driver, is organized to operate it, reporting to the station on alarm. A stream 160 ft. long was recently delivered by this pumper on test. Employees in charge of this work are (see accompanying illustration) left to right, A. G. McLean, assistant captain; A. M. Beaton, fire chief of the Cambridge company; W. C. Koeffler, captain of pumper squad.

Finally, the company has drawn up a mimeographed form termed a "Warden's Report," which is used to record types of bombs involved, location of damage and times that the various emergency units were dispatched to the scene of trouble.

DIAGRAM of defense organization



Experience of Utilities in Power Shortage Control

Cost in lost revenue and out-of-pocket expense a small price for result in improved customer relations — No drastic curtailment ordered, but a saving of 100,000,000 kw.-hr. achieved

WHATEVER may have been the cost in loss of revenue, in out-of-pocket expense, in diversion of employees' time and effort, in executive attention, it was more than amply repaid in improvement of customer relations. That's how most of the electric utilities in the Southeast feel about their experience in control of power shortage last fall and early winter. Indifferent and difficult customers became friendly, good friends were made better friends, as they were called upon, in a cards-on-the-table way, for help in meeting a situation affecting all.

This is the outstanding conclusion reached by ELECTRICAL WORLD from a study of utility experience in the southeastern power shortage. The study included two means of obtaining information, a mail survey and personal interviews with many utility men in the region; it covered both private and municipal utility operations.

Machinery Working

Although the shortage was not so severe as had been feared and control was not carried out to the lengths planned, yet the effort was full-dress in every way; all the mechanisms of control were set up and in operation. Therefore a review of experience should be interesting and instructive, particularly to utility men and others in regions where war demands may again cause shortages.

Issued October 30, 1941, OPM Limitation Order L-16, "To Curtail the Consumption of Electric Power in the Southeastern Area," required three actions. First was reduction beginning November 10, 1941, in energy usage by all customers, except those specifically exempted, whose normal rate of consumption was 2,500 kw.-hr. or more per week. Second was immediate discontinuance of power use for non-essential services, such as sign and other display lighting. And third was pooling of power resources in and around the affected area. The order was stated to be in effect until March 1, 1942. It is with experience in the first two aspects of the order that this article is concerned.

Curtailment of 30 percent was ordered in Alabama, Georgia, Tennessee, eastern Mississippi, northwestern Florida and southeastern South Carolina. Only 5 percent reduction was specified for the rest of South Carolina and for North Carolina. Discontinuance of display lighting was ordered for all the area.

As November 10 approached it was found possible to postpone the 30 percent curtailment until November 17 and to put off indefinitely the 5 percent reduction. Instead users were asked to "freeze" their energy consumptions at their normal rates of 2,500 kw.-hr. or more per week. Rains in November continued to improve energy reserves and drastic curtailment was again postponed, although the "freezing" at base week usages was made mandatory on November 17. Then on December 6 all restrictions, including that on display lighting, were removed. This is the chronology of power shortage control by OPM order in the Southeast.

The utilities from which information was obtained for this article have a total of some 110,000 customers in the small light and power class. Of these about 65,000 customers used display lighting of the kinds ordered discontinued by OPM. Perhaps the 65,000 figure is a little too high. It includes some customers, notably "tourist homes," in the residential class. Efforts to secure estimates of losses in revenue and energy sales caused by the blackout of display lighting were not wholly successful. Because of overlapping of billing periods estimation of these losses was difficult. Estimates received ranged from a low of 1.5 to a high of 12 percent in revenue and from 3 to 25 percent in sales of energy. The higher estimates were given by utilities serving the larger cities. This is logical because of the higher proportion of display lighting in the bigger communities. For utilities serving mostly small towns and rural areas a reasonable guess might be 5 percent loss in revenue and 8 percent in sales. For utilities with preponderantly metropolitan service areas the guess would be 10 percent loss in revenue and 18 percent in sales. It should be noted that the period of display lighting blackout was at a season of shortening days when rises in lighting bills were to be expected.

Exempt and Non-Exempt

Large power and light customers of the reporting utilities total 2,067. The curtailment order applied to 1,335. These were the non-exempt customers, each of whom used more than 10,000 kw.-hr. during the month for which his meter was read between September 15 and October 14 inclusive. Exempt customers included governmental, essential community, transportation and communication services, water supply and sanitation systems, military establishments and industrial plants exclusively en-

gaged in production of war-essential goods.

No attempt was made to reach any determination of losses in revenue and energy sales among industrial customers. No drastic curtailment of energy use was ordered and there is no knowing, hardly any guessing, what revenues and sales might have been if no control had been imposed.

All utilities in the region took paid space in newspapers to inform customers of the OPM order and its requirements initially, of the revisions in the order as they were announced and of the final lifting of restrictions. The order and its local application were news and many utilities took advantage of this popular interest to make releases to the press. Radio time was used freely. Letters sent directly to customers explained the intentions and requirements of the order. And last, but by no means least in profitable result, most utilities found the order and its carrying out to be the occasion for enlargement and renewal of personal contacts with customers.

Summary of Utility Weekly Reports to OPM

Exempt Customers

	Number of Customers	Weekly Quota Kw.-Hr.	Actual Use Week of Nov. 17, 1941	Actual Use Week of Nov. 24, 1941	Actual Use Week of Dec. 1, 1941	Actual Use Week of Dec. 8, 1941
Alabama:						
Municipalities	14	123,277		60,700	92,600	95,900
EMC & Coops	.....	.....		.....	.....	.....
Georgia:						
Municipalities	9	73,575		37,860	37,130	34,269
Cooperatives	2	12,933		7,601	3,894	7,392
TVA-Mun. & Coops.:						
Chattanooga	64	3,551,139		3,539,549	3,502,782	3,586,217
Knoxville	42	805,745		693,288	644,613	724,245
Memphis	79	1,927,427		1,948,825	1,970,045	1,934,075
Nashville	73	1,272,304		1,154,590	1,170,225	1,313,740
Others	239	1,371,963		1,948,433	1,966,258	1,926,618
Total Mun. & Coops	522	10,138,363		9,390,846	9,387,547	9,622,456
Private Companies:						
Alabama Power Company	217	4,214,181		3,497,028	3,653,677	3,824,172
Alabama Water Service Co	3	61,775		10,800	27,950	58,250
Birmingham Electric Co	80	1,637,328		1,314,351	1,465,399	1,453,890
Georgia Power Co	269	4,145,868		2,518,959	2,303,756	2,743,825
Gulf Power Co	30	295,669		207,746	198,161	194,848
Knoxville Power Co	3	49,924		70,200	68,500	67,700
Mississippi Power Co	60	855,789		1,021,537	1,106,291	1,147,701
Nantahala Power & Light Co	3	248,836		128,160	163,870	134,110
South Carolina Power Co	35	266,028		163,145	175,840	187,160
Total private companies	700	11,775,398		8,931,926	9,163,444	9,811,656
Tennessee Valley Authority	11	42,757,732		45,529,179	45,981,588	44,830,648
Grand total	1,233	64,671,493		63,851,951	64,532,579	64,264,760

Summary of Utility Weekly Reports to OPM

Non-Exempt Customers

	Number of Customers	Weekly Quota Kw.-Hr.	Actual Use Week of Nov. 17, 1941	Actual Use Week of Nov. 24, 1941	Actual Use Week of Dec. 1, 1941	Actual Use Week of Dec. 8, 1941
Alabama:						
Municipalities	5	30,776	81,740	42,500	26,090	30,160
EMC & Coops	.....	.....	.....	.....	.....	.....
Georgia:						
Municipalities	48	381,988	207,422	328,234	300,670	327,887
Cooperatives	5	102,047	.....	65,851	52,015	76,829
TVA-Mun. & Coops.:			15,837,383			
Chattanooga	128	3,865,014	.....	3,403,795	3,301,308	3,632,074
Knoxville	95	2,372,962	.....	2,134,536	2,045,600	2,237,406
Memphis	157	3,261,238	.....	2,731,240	2,166,455	2,510,395
Nashville	129	2,151,064	.....	1,862,760	1,750,906	2,059,480
Others	307	6,283,442	.....	5,501,321	5,203,019	5,576,495
Total Mun. & Coops	874	18,448,531	16,126,545	16,770,237	14,846,063	16,450,726
Private Companies:						
Alabama Power Co	281	22,470,288	22,058,803	20,434,386	21,132,921	21,327,673
Alabama Water Service Co	5	299,068	295,100	298,100	280,800	242,650
Birmingham Electric Co	150	4,203,682	.....	3,191,484	3,610,006	3,827,044
Georgia Power Co	561	23,932,982	18,905,010	21,432,764	20,000,224	22,034,831
Gulf Power Co	17	294,903	239,941	140,833	112,874	154,963
Knoxville Power Co	1	13,314	2,960	.....	.....	.....
Mississippi Power Co	73	1,189,250	1,048,450	1,008,083	1,016,303	1,014,332
Nantahala Power & Light Co	8	214,356	.....	183,260	188,840	201,880
South Carolina Power Co	55	1,819,202	1,691,690	1,591,480	1,652,550	1,625,610
Total private companies	1,151	54,437,045	44,241,954	48,280,390	47,994,518	50,428,983
Tennessee Valley Authority	6	12,962,159	5,578,500	5,576,570	5,530,100	7,295,420
Grand total	2,031	85,847,735	65,946,999	69,929,197	68,370,681	74,175,129

Responsibilities on Utilities

Application and enforcement of the order was put up entirely to the utilities by OPM, with the police power of Uncle Sam held in reserve. The study disclosed no instances of that power actually being used. On the extremely few recalcitrants it was enough simply to mention it. Thus the utility appeared to its customers, to the public, in a most favorable light, that of an agent incurring expense and giving up revenue to carry out orders aimed toward the common good. The utilities assiduously kept this picture of the situation in the forefront of their publicity, and particularly did they emphasize it in personal relations with their customers. Being a true picture, plain and simple in its outlines, it was quickly accepted and resulted in the improvement in customer relations stated at the opening of this article.

Reporting utilities stated a total of 64,075 customers affected by the blackout of display lighting and 1,335 coming under the energy curtailment order; in all, 65,410 customers concerned. For personal contacts with customers the utilities used 425 employees, mostly salesmen, some division managers and only a few others. The ratio is thus 154 customers per contact man. But this does not tell the story so well as do the ratios of individual utilities—63, 66, 72, 91, 100, 115, 199, 205 and 459. The wide range of these ratios prevents any conclusion regarding the optimum number of customers per contact man, but it is pertinent to observe that the most enthusiastic comments on improved customer relations were heard among the utilities with the lowest ratios.

Although the 30 percent curtailment was not ordered, it was necessary for the utilities to keep account of energy consumptions of affected power customers after November 17 when usages were frozen at 100 percent of base levels. In most cases this work, consisting of receiving—sometimes collecting — weekly postcard readings from customers, entering energy amounts in records and compiling weekly summaries of "under base" and "over base" consumptions for OPM, was done by power sales departments without extraordinary effort. Some additional work was required in keeping records of requests, and consents or denials to them from OPM, for exemptions and for changes in weekly base energy usages. But over all it seems that curtailment accounting was a job that could be nicely handled by existing forces.

Cost Indeterminable

It is obvious that administration of the OPM order imposed on the utilities a quite heavy burden of cost. But the greater part of the cost, represented by lost revenue and by diversion of employee and executive time and thought, is indeterminable. Even to arrive at a statement of actual, out-of-pocket, cost is difficult because it is impossible accurately to segregate from ordinary expenses of operation every item chargeable to the order—automobile mileage, postage, long distance telephone, telegraph, multigraphing, printing, clerical overtime, stationery, etc. Therefore the attempt made in the mail survey and in the personal interviews to ascertain the cost of the program in terms of money spent and exclusive of money lost was not productive of particularly valid results. But for what they are worth, here they are:

Total reported	$30,134,000
Total customers (commercial and industrial)	110,146
Cost per customer	$0.27

The range in cost per customer for individual utilities — $0.16, $0.17, $0.20, $0.37, $0.41, $0.59, $1.29 and $1.37—indicates the difficulty of estimating this cost in the single instance. However, the figure of 27 cents per customer, being weighted by numbers of customers and averaging the wide and near estimates, may perhaps be taken as valid in default of one more firmly based.

For an over-all picture of what was accomplished by the control program in curtailment of energy usages by large light and power customers refer to the tabulations accompanying this article. These data, furnished by J. A. Krug, head of the Power Branch of OPM, show a total saving of nearly 70,000,000 kw.-hr. in the four weeks of actual control. To this must be added the unrecorded, thus unknown, savings accomplished by the blackout of display lighting and by frugality in energy use of customers unaffected by the order, but trying to help out. A conservative estimate of the total saving would probably approach 100,000,000 kw.-hr. So much accomplished with so little friction, without invocation of police power, is an excellent demonstration of cooperation —intelligent and understanding on both sides—between business enterprise and government authority.

Analysis of Non-Exempt Customers by Type of Industry

Code	Class of Industry	Number Customers	% of Total	Weekly Quota	% of Total
E A	Dairies	70	5.93	428,433	0.67
B	Bakeries	51	4.31	390,456	0.61
C	Ice cream manufacture	27	2.28	179,844	0.28
D	Cheese manufacture	4	0.34	23,821	0.04
F	Meat packing & storage	67	5.67	766,128	1.20
G	Canning	12	1.02	61,434	0.10
H	Cotton oil mills	59	4.99	2,923,070	4.60
J	Ice manufacture and refrigeration	309	26.14	3,771,748	5.93
K	Water supply	130	11.00	1,275,846	2.01
L	Hospitals & doctors' buildings	62	5.25	628,754	0.99
M	Government buildings	24	2.03	204,561	0.32
N	Communication and radio	39	3.30	313,813	0.49
P	Schools	72	6.09	598,430	0.94
Q	Transportation and service	87	7.36	1,772,524	2.79
R	Gas service	5	0.42	63,151	0.10
S	Street lighting & highway	40	3.38	387,761	0.61
T	Army & navy reserve	18	1.52	898,715	1.41
U	Aluminum	6	0.51	36,304,023	57.12
V	Copper	1	0.09	1,204,931	1.90
W	Manganese	5	0.42	580,692	0.91
Y	Munitions	6	0.51	297,178	0.47
Z	Newspapers	20	1.69	157,129	0.25
AB	Steel	5	0.42	309,763	0.49
AM	Miscellaneous	63	5.33	10,021,070	15.77
		1,182	100.00	63,561,275	100.00

Analysis of Exempt Customers by Type of Industry

Code	Type of Industry	Number Customers	% of Total	Weekly Quota	% of Total
A	Steel mills and rolling	11	0.53	5,080,295	5.78
B	Foundries and castings	36	1.73	1,202,042	1.73
C	Slag grinding	3	0.14	102,473	0.12
D	Machinery	23	1.11	881,876	1.00
E	Stoves	12	0.58	122,063	0.14
G	Railway equipment	2	0.10	190,575	0.22
H	Machine shops	8	0.38	98,306	0.11
J	Other steel & iron fabrication	59	2.84	2,307,764	2.63
K	Iron ore mines	9	0.43	348,153	0.40
L	Textiles and cotton cloth	387	18.60	34,308,033	39.07
N	Cotton gins	148	7.11	609,539	0.69
P	Rubber products	8	0.38	3,075,236	3.50
Q	Cement, clay, sand, gravel, etc.	171	8.22	6,726,409	7.66
R	Furniture, woodworking, etc.	113	5.43	867,756	0.99
S	Paper and insulating	36	1.73	3,944,621	4.49
T	Fertilizer and limestone	32	1.54	400,737	0.46
U	Miscellaneous chemicals	49	2.35	16,373,815	18.64
V	Oil refineries	5	0.24	205,534	0.23
W	Flour mills	1	0.05	48,000	0.05
X	Bottling plants	21	1.01	115,039	0.13
Y	Feed & grain mills	36	1.73	403,736	0.46
Z	Other food processing	35	1.68	566,870	0.65
AA	Prison factories	2	0.10	148,239	0.17
AB	Coal mining	69	3.32	2,765,971	3.15
AE	Laundries	41	1.97	145,047	0.17
AF	Restaurants	65	3.12	274,884	0.31
AG	Theaters	75	3.60	452,180	0.51
AH	Stores	281	13.50	2,382,870	2.71
AJ	Hotels and apartments	96	4.61	1,061,580	1.16
AK	Office buildings & banks	125	6.01	1,079,469	1.23
AL	Government buildings	32	1.54	210,921	0.24
AM	Miscellaneous	90	4.32	1,367,308	1.56
		2,081	100.00	87,822,341	100.00

War-Time Engineering Marks A.I.E.E. Sessions

Orthodox engineering papers partly superseded by conference discussions of emergency distribution, interconnection governing, stability, maximum system production and lighting for defense

"THAT WE CAN, in the face of all the new problems brought by the war, be discussing these continuing developments is both encouraging and astonishing," said Past-President Sorensen at one of the A.I.E.E. winter convention sessions in New York January 26–31, 1942. Actually the program was a well-balanced assembly of orthodox engineering papers in conjunction with others highly pertinent to current developments intensified by war measures. Whether some of the peacetime studies could be continued and reported upon at subsequent meetings was a fear frequently heard expressed.

Utility and industrial distributions to function in the face of greatly increased demands forecast by J. A. Krug (WPB) was one pair of lively session topics; another was the technique of civilian defense lighting. Governing of prime mover units during system interconnection changes in load started the power subjects on the first day. Motor drives of record-breaking size for wind-tunnel tests of experimental plane models evoked a discussion which verged into educational channels.

Meanwhile, the advances in air-blast circuit breakers, in temperature limitations and standards, success with single-pole reclosure in system switching, the status of rates of rise of recovery voltage, station grounds and shielding, and metering progress occupied a familiar and active place on the program.

Attendance was over 1,200, an average winter meeting figure.

General Session

Perhaps the electrical industry and other users of the metal can look for relief in the copper situation in 1943, said N. G. Symonds, former Westinghouse vice-president and now of WPB, in the principal address at the general session. He urged his engineer hearers to find ways to use less copper, to get away from the probably too high factors of safety which have been habits for so long. New thought might be given to the bare neutral controversy as a means for conserving copper. The vast quantities of planes, tanks, ships and other war material necessary to winning the war are a challenge to the engineering talent of the nation, asserted Mr. Symonds.

D. C. Prince, president of the Institute, said he felt there should be no relaxation of A.I.E.E. activities on account of the war. On the contrary, he thought they might properly be intensified because of their obviously greater value in the circumstances. More conferences with informal papers and discussions and fewer formalized technical sessions were in prospect for coming meetings of the Institute, was the opinion expressed by P. L. Alger, heading up program activities. Mr. Alger asked for program suggestions to keep institute meetings in pace with the fast-moving problems of war time.

Power for War Production

Be prepared to overload equipment and learn to "make the most of what you have," was the advice of Walker Cisler (WPB) to power engineers in his opening remarks at the first of the two power generation sessions. Further, the stability characteristics of prospective or potential interconnections should be studied; unnecessary refinements should be stripped from design specifications even though it means a pause in the laudable evolution to improved performance. He urged that briefs for projects be submitted in full detail, not failing to report the possibility of obtaining access to such local capacities as generators in industrial plants left idle by a purchased-power program.

Presentation of Alfred Noble Prize to Robert F. Hays, Jr., Westinghouse, by Prof. James K. Finch, Columbia, while D. C. Prince, president of the Institute, looks on

Technical papers at the two sessions were a logical continuation of the Philadelphia and Toronto symposia of 1941 and most timely, he said:

A Turbine Governor Performance Analyzer. By **W. C. Osbon,** (Westinghouse).

Coordinated set of indicating instruments —oscillograph for load, steam-valve travel, oil pressure recorder, oscillograph for angular velocity of turbine shaft—affords a check of governor characteristics and performance.

Control of Tie-Line Power Swings. By **C. Concordia, H. S. Shott** (both General Electric) and **C. N. Weygandt** (Univ. of Penn.)

Analytical and comparative study of floating, proportional and intermittent control system; effects on governor response and tie-line load as to instability and fidelity.

Supplementary Control of Prime Mover Speed Governors. By **S. B. Crary** and **J. B. McClure** (General Electric).

Flat-frequency controls are not inherently good time standards; objective largely abandoned. Advantages of time-error droop control will accrue as interconnections and frequency regulating stations increase.

Synthetic or Equivalent Load Curves. By **R. F. Hamilton** (consulting engineer).

Approximate methods of analyzing load-curve characteristics as to consolidated peaks, losses and required capacities. Mathematical and graphical procedures.

Facilities for the Supply of Kilowatts and Kilovars. By **H. K. Sels** and **J. Seely** (both Public Service Electric & Gas Co.).

Generators rerated to 100 percent p.f. Auto-transformers step up generator voltage. Kilovar capacity from static capacitors most economical, from added generator copper next; synchronous condensers most expensive. Merit in viewing kilowatt and kilovar capacities separately.

On the Osbon paper Messrs. Concordia and Shepard (General Electric) cited an instrument which traces the frequency change and valve motion in loop form; it can be applied and adjusted with the turbine and governor in operation.

Many widely held but erroneous notions should be dissolved by the two governor papers, said Paul Juhnke. Commonwealth Edison tests on an isolated 60,000- to 100,000-kw. load varied by 4 cycles showed 0.2 percent load change accompanying 0.1 percent in frequency, the rest attributable to voltage. A 3 percent voltage change caused 50,000 kw. change in 1,620,000 kw. Poor governor regulation, Juhnke said, may be found in machines designed primarily for base loads.

J. E. McCormack (Consoliated Edison) said that in New York no attempt is made to confine load changes to one point; the effect is allowed to diffuse for absorption and recovery. Above all, he advocated communicating the worries and fruits of governor studies to the station operating staffs.

Inadequacy of tie-line capacity defeats desirable operation of interconnection, asserted H. S. Dryar (Philadelphia Electric). The marginal station should be the one to pick up or drop load and tie-line load should go as it wants to go. He averred that he does not believe in automatic frequency control because it takes the job away from the governors, "where it belongs." McCormack had also favored more or less continuous manual control.

Large load swings were attributed by F. E. Sandstrom (Consolidated Edison) to human factors. Between 6 to 9 a.m. the New York load grows 1 percent per minute. Stokers will pick up 1½ percent per minute, but the "steam man balks at 2 percent." Governor regulations are three times the optima cited in the papers. Similarity in governors is desirable and tie-line bias control is preferable, said Sandstrom.

Caution about strains and temperature differences with changing turbine loads and with turbine washing was advocated by G. B. Warren (General Electric), who said, however, that there is no great evidence that turbines subjected to varying load require more maintenance. The order of temperature sensitivity was set down as (1) single shell, 1,800 r.p.m., (2) single shell, 3,600 r.p.m., (3) double shell, 1,800 r.p.m., (4) double shell, 3,600 r.p.m.

Tie-line load control appears better for long lines in a loosely tied system than for short lines in a compact system, said S. B. Crary (General Electric).

Switching Equipment

Field Tests on High-Capacity Station Circuit Breakers. By **H. D. Braley** (Consolidated Edison, N. Y.).

One of 24 15-kv. air-blast breakers (500 to 2,500 mva.) at Sherman Creek tested on isolated bus at Hell Gate with ties elsewhere. Wall bushings reinforced. System data obtained simultaneously. Calculated currents higher than actual.

Field Tests on High-capacity Air-blast Station-Type Circuit breakers. By **H. E. Strang and W. F. Skeats** (both General Electric).

15-kv., 1,500-mva. unit closed 111,000 amp. in first tests at generator voltage and opened satisfactorily at full rating. Confirms factory test with new synthetic circuit.

Field Tests and Performance of a High-Speed 138-Kv. Air-Blast Circuit Breaker. By **Philip Sporn** (American Gas & Electric) and **H. E. Strang** (General Electric).

The breaker of Rankin-Bennett 1941 paper. Tests up to 10,300 amp. closing and 7,800 opening (3-phase) 1,860 mva. showed breaker operating times 5.1 to 6.3 cycles. Reclosures (similar limits) 17.7 to 23 cycles.

A 2½-Million-Kva. Compressed Air Power House Breaker. By **L. R. Ludwig, H. M. Wilcox, B. P. Baker** (all Westinghouse).

Tests (31 consecutive) up to 135,000 amp., 13.2 kv., three-phase, air at 125 psi.

J. B. MacNeill, Westinghouse; W. S. Edsall, Allis-Chalmers; E. S. Bundy, Niagara Hudson; M. S. Oldacre, Commonwealth Edison; R. T. Henry, Niagara Hudson; V. M. Montsinger, General Electric; R. W. Sorensen, California Tech.; R. M. Spurck, H. E. Strong and C. H. Black, all General Electric

Maximum closed current 247,000 amp. crest. Maximum arcing time 0.8 cycle or less. Highest recovery rate impressed 13,600 volts per ms.

A Fast Circuit Breaker. By **D. I. Bohn** (Aluminum Co.) and **Otto Jensen** (I-T-E).

Quarter-cycle anode breaker for rectifier duty. Discusses design of trip-free mechanism for minimum weight and maximum speed. Tested across two 3,000-kw., 600-volt d.c. generators with rise at 5½ million amperes per second.

High-Capacity Circuit Breaker Testing Station. By **J. B. MacNeill** and **W. B. Batten** (both Westinghouse).

Two 60,000-kva. generators added; in parallel they afford three-phase symmetrical short of 2,000,000 kva. at 13.2 kv. Stored energy of each rotor 8,500,000 lb.-ft.-squared. Transformers give up to 230 kv. Igloo for —20 F.

Circuit breaker testing on high concentrations of power is likely to be taboo for the duration and developments will presumably have to come from adequate laboratory tests, said J. B. MacNeil (Westinghouse). He felt the Hell Gate tests reported by Braley had reached the safe limit. Actual high voltage tests are preferable for high-voltage breakers because of charging current and restriking characteristics. Tortuosity of path was seen as the reason for needing as high as 350 psi. in the G.E. breaker. H. E. Strang (author) refuted this, saying the valve drop is three to eight times as important as the angles and bends in the air path; the valve opens in 2 cycles and full pressure exists in the arc area a whole cycle before contact parting.

Recovery voltage rates of 160 to 390 kv. per microsecond were found in the Hell Gate tests, generally considerably less than calculated values. At Sherman Creek the calculated recovery rate on the 500,000-kva. feeder breakers is 2,400; the 1½ and 2½ million will be built for 4,600 kv./ms.

Recovery voltage rates as high as 12,000 kv./ms. have been found for some systems, according to L. R. Ludwig (Westinghouse). The compressed air breaker is strongly affected by the rate of recovery of voltage, he said.

Pictures of "shrapnel-scattering" tests of oil breakers were shown by B. M. Jones (Duquesne Light) in support of his advice that careful, meticulous planning of field tests is imperative.

The new associates in the field represented by the papers were welcomed by W. S. Edsall (Allis-Chalmers), whose company had consistently advocated the compressed-air breaker. A new 220-kv. breaker has 3-cycle opening and 9-cycle reclosure. He urged careful prescription of recovery voltage provisions in standards.

Shawinigan Water & Power has several high-speed, high-voltage air-blast breakers and will shortly have five of 220 kv. These are all 250 psi. and E. W. Knapp questioned the need for 350 psi. Drying of air is important (as is a good check for dryness); moisture, condensation and cement porosity have to be watched; good machining of parts is important, he said.

Allis-Chalmers, H. V. Nye reported, is constructing two 13-kv., 1,000,000-kva. outdoor compressed-air breakers insulated for 34½ kv. Out of 97 operations in testing a 5-kv., 150,000-kva. breaker 25 percent were approximately 40,000-amp. breaks; the contacts were stated to be in good operable condition.

H. A. P. Langstaff contrasted the low-voltage functioning of the solenoid-operated breaker with the air-operated, saying that reduced voltage is nevertheless often not so low as not to trip. The refinements of breaker testing laboratories, he said, tend to enhance user confidence that breakers are truly approaching the ideal.

One shortcoming of laboratory tests, according to R. A. Hentz (Philadelphia Electric), is the relatively low recovery rate. Most of the difficulties with air breakers lie in the air systems, he has found.

More than 100 tests have already been carried out at the Roller-Smith laboratory connected to the P. P. & L. system (as already described in ELECTRICAL WORLD), stated Joseph Wood.

W. F. Skeats (General Electric) felt that new and existing forms of breakers can be tested equally well with dual power supply in the laboratory—heavy fault current followed immediately by high-recovery-rate voltage.

System Switching

High-Speed Single-pole Reclosing. By **J. J. Trainor** (P.S. of Ind.), **J. E. Hobson** (Ill. Inst. of Tech.) and **H. N. Muller, Jr.**, (Westinghouse).

Raises the transient power limits on 138-kv. grounded neutral system 42 percent higher than gauged three-phase for single line-to-ground fault with 35-cycle reclosure. Permits slower reclosure to allow more time for high-voltage arc clearing.

Relays and Breakers for High-Speed, Single-Pole Tripping and Reclosure. By **S. L. Goldsborough** and **A. W. Hill** (both Westinghouse).

Companion to above paper. Uses phase-shift of one sequence component to trip the proper conventional residual type ground relay. Reclosure is conventional. Breaker has magnetic interlock for trip-free action.

Performance of Ground Relayed Distribution Circuits During Faults to Ground. By **C. L. Gilkeson** (Va. E. & P.), **P. A. Jeanne** and **J. C. Davenport** (Bell Tel. Lbs.).

Four-wire multi-grounded neutral. Average clearing before first reclosure at 70 percent; fault to breaker opening, 7 to 15

F. S. Brown, Duquesne Light; P. L. Alger, General Electric; K. A. Hawley, Elpeco; J. J. Torok, Corning Glass; L. W. McCullough, Consolidated Edison; R. E. Hellmund, Westinghouse; G. A. Matthews, Detroit Edison; C. A. Powel, Westinghouse

A. J. Krupy, Commonwealth Edison; L. F. Hickernell and H. G. Burd, both Anaconda; A. Ames, Kerite; L. B. Bonnett and H. S. Wilson, Consolidated Edison; A. E. Knowlton, Electrical World

cycles; fault to first reclosure, 34 to 57 cycles. Sectionalization satisfactory except for fuses less than 40 amp. rating. Ground relay settings 50-100 percent (but not less than 25-35 amp.) realizable.

Analysis of the Application of High-Speed Reclosing Breakers to Transmission Systems. By **S. B. Crary, L. F. Kennedy** and **C. A. Woodrow** (all General Electric).

Analyzes merits of three-phase reclosure. Single-pole reclosure deemed most appropriate for small interconnections. Advocates holding it to line-to-ground faults. Urges further study of deionization times.

Relative Value of Different Types of Overcurrent Protection for Distribution Circuits. By **G. F. Lincks** (General Electric).

Mathematical study, under rigid assumptions, of combined branch protection and line sectionalizing, overlapping of substation reclosing with line protective devices. Many working curves included.

Is it better to design lines for stability through multi-phase faults or only for one-phase-to-ground, asked L. F. Kennedy (General Electric), who expected continuance of the trend in designing for optimum performance, thereafter selecting appropriate switching.

No one is better qualified to sense the alternative value of ground fault neutralizers than Public Service of Indiana, said J. J. Trainor, because the company has several and more on order. In fact, they have almost half the installations and line-mileage so protected and there is no substantial difference in fault-clearing performance. One drawback of the ground-fault neutralizer is the number of sectionalizing-insulating transformers required and the impedances interposed by them. He feels that single-pole reclosure introduces less system shock, tie-lines can carry excess power better during emergencies and, in general, the single-pole scheme has all the advantages of ganged 3-pole.

Instantaneous relaying and reclosure applied to urban circuits gives performance equivalent to loop service, said William Shuler (Dayton) in comment on the Lincks paper. Conductor damage is materially reduced; arc nicks being largely eliminated. On rurals reactors are used, expecting to carry by with 150-amp. fuses. It is expected coordination can be carried down to 40 amp.

REA is experimenting with a carrier-current outage recorder, said Bruce O. Watkins, and also a carrier communication system. Only one in 1,500 reclosure devices has failed. Where percentage of temporary faults is high fuses are applied to sectionalize. Many one-pole reclosers can be bought for the price of one substation.

Generous information in the Lincks paper was called highly timely by R. O. Loomis (Georgia Power). Sectionalizing is valuable wherever circumstances lenthen the time to effect repairs.

Col. L. G. Smith (Baltimore) said fuses were now pretty dependable, but he was disturbed because the work of the joint NEMA-EEI committee had come to an impasse after making real progress in standardizing the characteristics. Restoration after feeder trouble without lockout of station breakers is typical performance, he said.

Standard Ratings

"Hot-Spot" Winding Temperatures in Self-cooled Oil-insulated Transformers. By **F. J. Vogel** and **Paul Narbutovskih** (both Westinghouse).

Hot spot allowances and gradients found less than supposed, permitting, say, 200 percent vs. 138 percent load for one hour. Tests and calculations on 2,000-kva., 44-kv. transformer. Copper 46.6C vs. 41.4C calculated. Oil temperature difference proportional to square root of loss-viscosity product.

The general method described in the paper is correct, said W. C. Sealey, (Allis-Chalmers) and has been in use for several years. However, the application of the method as recited by the authors contains certain inaccuracies. The conclusions presented are not conservative, as claimed, but are otherwise, because non-typical transformers with unusually low temperature rises were used as data sources. Also values of temperature gradient even lower than permitted by these data were assumed and used in calculations. L. Wetherill, General Electric, particularized the material of the paper by a lucid discussion of circulation of oil in self-cooled core-type transformers. Disagreement with the authors' statement of much higher possible overloads was voiced by V. M. Montsinger (General Electric) for several reasons, among which was the assumption that change in oil viscosity counteracted increased loss. Actually, he said, the effect of this change is small—in the order of three or so percent of the overload values obtained.

H. C. Lewis (Consolidated of Baltimore) inquired how much revision should be made in transformer depreciation ratios in view of these new overload limits. Lee Clarke (Detroit Edison) suggested that trial overloads under controlled conditions be made in order to observe performances of transformers before allowing overloads to come on in service because of the danger, for one thing, of oil overflow resulting from expansion and for another, off-scale, and thus unreadable, meter indications. A bi-metal thermal alarm device, obviating the meter difficulty, was de-

scribed by H. L. Prescott (Westinghouse). And for a final word, R. T. Henry (Buffalo Niagara) said that efforts to estimate the effects of overloads on transformer life were entirely futile since it is impossible to estimate such life in any instance.

Conference on National Defense Lighting

Scientific bases for recently announced conclusions that dim red is better than blue light for essential seeing in blackouts were set forth by Kirk Reid, Nela Park, in the conference on national defense lighting on the first day of the convention. People on the ground see better by red light than by blue and red is less visible from the air. Many of the ways in which the advances of late years in the lighting art may be used to facilitate necessary activity during blackouts were cited and demonstrated by Samuel Hibben, Westinghouse. From the talks on civilian defense by Col. Walter P. Burn and on blackouts by Lieut. Col. Edward B. Towns came these impressions: When the Army orders a blackout for any area then the order will mean just that—no lights. While there is undoubtedly much truth in contentions that complete blackout does not always nor even often prevent enemy aviators from finding urban area targets, the proposals for confusion-pattern lighting, for "dim-outs" and the like are not likely of immediate acceptance. Substantial bombing of any objective in this country is not at present to be feared; it is more to be expected that any air-borne attack we may experience will be only "token" bombing. Industries vital to war production should take steps immediately so that when and if a blackout order comes they will be able fully to comply with such order without interruption to production. Householders and civilian service businesses should not now make demands for blackout materials, curtains, special lights, etc., because such materials and equipments can be much more usefully employed in protection of premises where war goods are being produced.

War-time Distribution

Electric Power Distribution Systems in War Time. By **Philip Sporn** (American Gas & Electric Service).

Introduction to the symposium. Urges reexamination of distribution philosophy.

Power Supply to Distribution Substations in War Time. By **H. P. St. Clair** (American Gas & Electric Service).

Supplementary cooling for transmission substations. Loss of life curves emphasize lowered ambient. Portables on railroad cars. Extension of breaker capacities. Tapping lines with low-cost substations. Relative incidence of thermal and regulation limits on shorter lines. Suggests using all of three or more lines at peak where voltage is limiting factor.

Underground Distribution Systems in War Time. By **L. R. Gaty** (Philadelphia Electric)

Change to network, paralleled primaries, protective measures, fault location, maintenance, supervisory alarm, realization of thermal capacities, (sheath, duct, transformers), comprehensive records.

Overhead Distribution Systems in War Time. By **Harold Cole** (Detroit Edison).

Conserve critical materials: minimum use, more effective use, salvage. Short-cut routes. Increased loading of wire and transformers. P.F. improvement. Voltage regulation.

Distribution Substations and War-time Necessities. By **F. C. Poage** and **M. W. Reid** (both Ebasco Services).

Artificial cooling, paralleled regulator windings, paralleled breakers, intensified breaker maintenance, duct ventilation, higher bushbar temperatures, capacitors, "borrowed" duplicates, automatic reclosure, simplified structures, and layouts, unit substations, portable substations, protective equipment.

Timeliness of the distribution symposium was accorded by Thomas R. Tate (FPC), who emphasized the fact that tremendous war demands will have to be carried largely by present facilities even if use curtailment has to be imposed. Skimped systems will have the most trouble; load factors rise to dissolve diversities; eternal vigilance will have to be applied in protecting equipment in every way in the absence of replacements, he asserted.

Definite risk that distribution may prove more a bottleneck than generation confronts us in the opinion of M. M. Samuels (REA). He missed one point in the otherwise admirable resume of the symposium and that was the control of loading by voluntary or forced lopping at peak periods. He urged mobile capacity "like fire engines." We may brag of a 50,000-kva. portable substation, but the Germans have dozens of 100,000 kva., he said.

Relaxation of regulatory requirements as to voltage departures was advocated by Floyd M. Fuller (Penn. P. & L.). The factor of safety of 3 for crossing guys could be waived as another typical relief.

"Bold and courageous steps" for one company may be the routine practice for another where financial latitude is broader, said H. E. McDowell (Ebasco). The capacitor is the most versatile and reclamable way of enhancing system capacity. Too few companies have derived the benefits of paralleled transformers because the belief that it is a tricky scheme seems to die hard, he said.

A. C. Streamer and A. K. Parks, both Westinghouse; G. W. Clothier, W. J. Devers and H. V. Nye, all Allis-Chalmers

Rochester Gas & Electric has reverted to two-wire service, said G. H. Fiedler, and there have been few voltage complaints.

Every accepted practice and standard should be reappraised and even challenged, said N. W. Smeloff (Penn. P. & L.) and the greatest unsuspected margins will be unearthed in the process. He challenged too quick reclosure, in that more delay conserves breaker capacity. Cooling is a "wet-bulb" phenomenon and consumes little water. Mobile capacitors have been thoroughly justified; maintenance can be done in weekday daylight by installing one to help out on voltage while a nearby sub carries the load.

Chicago has been working cables at elevated temperatures for a decade, reported Herman Halperin, but he advised against precipitate moves in that direction. The war may last several years and it would be disastrous to shorten insulation life so much as to result in collapse before the emergency ends.

Sequence tripping of group breakers has been a money-saving institution for Duquesne Light, said B. M. Jones. Also tapping of 66-kv. lines has proved successful. The operating men are enthusiastic about the values of a recent regulating transformer. Current transformers proved to be the real bottleneck in several lines.

Savings have been effected by Public Service Electric & Gas by pairing two transformers and circuits on a single circuit breaker, said R. G. Hooke. Hotspot temperature of 115 C. has been adopted for substation transformer. Studies indicate that failure rates on transformers and cables may be too low for best over-all peacetime economic balance. A 37 percent increase in peak in three years has been met by system capacity increments (per customer kw.) no higher than what generation alone usually has cost.

Lightning Progress

Impulse and 60-Cycle Characteristics of Driven Grounds—II. By **P. L. Bellaschi** and **R. E. Armington** (both Westinghouse) and **A. E. Snowden** (Carnegie Inst. of Tech.).

Lowered resistance with increase of current indicates soil breaks down at critical voltage gradient, enlarging the effective radius and length of the rod. Lead and ground inductance significant for fast discharges.

Shielding of Substations. By **C. F. Wagner, G. D. McCann** and **C. M. Loar** (all Westinghouse).

Model tests on effectiveness and mutual protection of masts. High earth resistivity not important if extensive grounding system is provided.

Lightning Investigation at High Altitudes in Colorado. By **L. M. Robertson** (P.S. of Col.), **W. W. Lewis** and **C. M. Foust** (both General Electric).

Shoshone-Denver 100-kv. line has counterpoises; ¾ of 145 strokes negative and 2,000 to 96,800 amp. Weaker currents at higher altitudes; inferred that at 18,000 ft. there may be no strokes.

Lightning Investigation on 132-Kv. Transmission System of American Gas & Electric Company. By **I. W. Gross** and **G. D. Lippert** (both A. G. & E. Service Corp.).

4,158 records total 8,955 instrument-years in nine-year program covering counterpoises, conductors, towers and ground wires. Maximum 150,000 amp. Multiple short counterpoises superior. Leg bonding advisable.

Influence of Towers and Conductor Sag on Transmission Line Shielding. By **R. W. Sorenson** and **R. C. McMaster** (both Cal. Inst. of Tech.).

Surge-generator model tests show Wagner-McCann-MacLane protection values are conservative because they omit protection provided by towers and line sag. Added protection 20 to 80 percent.

Lightning Investigation on Wallenpaupack-Siegfried 220-Kv. Line of Pennsylvania P. & L. Co. By **Edgar Bell** and **F. W. Packer** (both P.P. & L.).

Fifteenth year of study; records evolution in experimentation and philosophy. Résumé shows 20 percent of drop within 5 ft. of footings and no interruption caused by presence of measuring devices or auxiliary equipment. Significant results digested in table.

C. J. Firth, Philadelphia Electric

J. L. Sanborn, General Electric; L. K. Murphy, Consolidated Edison

When the lightning subcommittee was formed, sixteen years ago, it was thought that it would have a three-year job to explore lightning thoroughly, Philip Sporn said in the opening the session. There evidently is plenty still to be fathomed, but the war may interpose obstacles to aggressive continuance of the studies, he feared. The convention session on lightning showed no sign of diminution in activity or interest.

Considerable discussion centered around the issue of using 1,000-kv./ms. as the rate of rise in tests of transformers, arresters and related apparatus. J. T. Lusignan (Ohio Brass) said it is not difficult to design line insulation for that value or even higher although it is costly; he would not like to see a higher value adopted. P. L. Bellaschi (Westinghouse) explained the origin of that testing benchmark and said that, while present field values are merely approaching it, higher values can be expected as data from wood-pole lines multiplies. C. M. Foust (General Electric) cited a 2,000 kv./ms. value from a 220-kv. line relatively unprotected as justifying the adherence to a 1,000 value for a well-protected substation.

Data is still needed on the elevation of the ground plane due to high station structures, said G. D. Floyd (H.E.P.C., Toronto), adding that, for a given coverage, a combination of masts and lightning wires is usually cheaper than either alone.

That the mechanism of conduction in soil is largely electrolytic was the opinion advanced by W. E. Burkey (Westinghouse), but there was little support from others. One suggestion (by H. Treadway, REA) was that

C. H. Sanderson, Consolidated Edison; D. P. Orcutt, Electric Storage Battery; E. M. Toomey, Consolidated Edison

D. E. Moat, Leeds & Northrup; P. L. Hoover, Case School; W. H. Hough, Reliance Electric; C. W. Fick, General Electric

W. E. Barker and H. J. MacDonald, both U. S. Rubber; Arnold Raines, Frankford Arsenal; Ed McConnel, EEI; Howard Weber, U. S. Rubber

the ground rod and lead are essentially an imperfect condenser in series with R and L; at series resonance the contact resistance is effectively shunted out and the R indicated is really the earth-leakage resistance.

Another moot question was the decreased frequency of lightning strokes at high altitudes such as the Denver-Shoshone line; G. D. McCann and C. F. Wagner (Westinghouse) felt that data was as yet insufficient to support that conclusion of Robertson-Lewis-Foust paper.

Total impedance of tower and ground impedances may occasion flashovers even if tower inductance alone may be insufficient, said E. R. Whitehead (Duquesne Light) in urging a study of the transient characteristics of the whole structural and ground impedance pattern.

Resistivity of soil configurations to surge potentials is being studied at Purdue by J. R. Eaton, reported Prof. C. F. Harding.

The 1½ x 2-in. strap iron counterpoise has not been a temptation to theft and in ten years there has been no evidence of corrosion, said G. D. Lippert (American Gas & Electric Service).

Measurements

Improvements in Modern Meter Testing Technique. By **E. E. Lynch** and **M. A. Princi** (both General Electric).

Test and adjustment coordinated with production-line assembly. Moving and stroboscopic disk images employed. Creep-zero for light load. Disk speed-displacement discussed. Lag set mechanically, full load at 200 percent. Scale error shown graphically and simultaneously for all three loads.

Measurement of Maximum Demand. By **P. M. Lincoln** (Therm-Electric Meters).

Discusses peak-splitting weakness of block-interval meter in light of comparative tests at Ithaca. Analyzes characteristics of Bourdon tube demand wattmeter. Advocates standardization of demand time-interval.

Design of Long-scale Indicating Instruments. By **A. J. Corson, R. M. Rowell, S. C. Hoare** (all General Electric).

Reports design methods used to get long scales in compact instruments. Savings on 4½ vs. 6-in. instruments; panel-space 42 percent, weight 16 percent, both with ⅓ increase in scale length.

The Acceleration Oscillogram Method of Motor Torque Measurement. By **C. R. Atkinson** and **E. G. Downie** (both General Electric).

Time-speed oscillogram obtained from low-ripple permanent-magnet type d.c. generator gives starting torque and acceleration.

Mechanism of demand measurement and allocations will probably never be more exact than the field of apparatus temperature limitations on which it is based, said P. A. Borden (Bristol Company), who expressed preference for the logarithmic-thermal method even though it is harder to explain than the block-interval type.

Millions of Americans, however, who prefer the block-interval means can hardly be wrong, implied W. J. McLaughlin (General Electric), pointing out that it had survived several assaults between 1915 and 1942. Peak-splitting is much less significant than asserted by Professor Lincoln; also ability to serve often hinges on voltage limitations rather than equipment temperatures, he said.

Comment on the Atkinson-Downie paper was largely on motor characteristics or that the method was not at all new, having been patented a decade ago.

System Protection

Back-up Protection of the Boulder Dam-City of Los Angeles Transmission Line. By **C. P. Garman** (Los Angeles) and **L. F. Kennedy** (General Electric).

Complete duplication of primary protection unjustified. Consists of separate relays (same CT, PT) to trip if primary relays fail to clear fault in predetermined time. Functioning involves inherent back-up features of primary carrier-current pilot protection.

Temperature and Electric Stress in Impregnated Paper Insulation. By **J. B. Whitehead** and **W. H. MacWilliams, Jr.** (both Johns Hopkins).

Indicates deterioration may begin earlier and increase more rapidly than commonly supposed—dielectric loss at 80C. and 400 v.p.m. fifty times faster than at 80C. without stress or at 40C. and 400 v.p.m.

Field Investigation of the Characteristics of Lightning Currents Discharged by Arresters. By **I. W. Gross** (American Gas & Electric Service), **G. D. McCann** and **Edward Beck** (both Westinghouse).

Fulchronograph studies added; 70 percent of phase leg currents on solidly grounded neutral system found under 1,000 amp. Wave fronts 2 to over 25 ms. at maximum rise 2,500 amp. per ms. Time to half value decline averaged 25 ms.

Distribution-type Lightning Arrester Performance Characteristics. By **Subcommittee of Committee on Protective Devices.**

Up-to-date characteristics reported for valve-type arresters from 3 to 15 kv. from collated manufacturers' data.

It is possible, said W. R. Brownlee, Commonwealth & Southern, in reference to the Garman-Kennedy paper, that the need for back-up protection on transmission systems may be reduced by improvements in circuit breakers and associated devices and by assiduous inspection and maintenance of such equipment. Several discussers, among them H. A. P. Langstaff, West Penn, and E. R. Whitehead, Duquesne Light, referred with some disappointment, it seemed, to the fact that the Gross-McCann-Beck paper contained no records of lightning currents of high magnitude, the highest being 9,600 amp., while discharges up to 20,000 and above are not uncommon. The low values and slow rates of rise so far measured, said Mr. Whitehead, make it necessary to infer the characteristics of the heavier discharges which is not a satisfactory basis for lightning protection design.

Paper is commonly used as the dielectric in capacitors and is worked at as high or higher temperatures and stresses, but the paper in them does not show as high power factors as oil-impregnated paper used for cable insulation, said L. J. Berberich, Westinghouse, in discussing the Whitehead-McWilliams report. W. A. DelMar, Habirshaw, mentioned the possibility of oil oxidation to explain the higher power factors at the higher temperatures. Herman Halperin, Commonwealth Edison, instancing cable tests with paper temperatures up to 140 deg. C., asserted that insulation deterioration does not start at the comparatively low heat levels included in the Whitehead-McWilliams research. R. W. Atkinson, General Cable, opined that the difference between the results in the paper and those arrived at by cable tests was perhaps due to the research use of unconfined as against confined oil in cables. R. J. Wiseman, Okonite, urged ionization as the cause of paper deterioration, disagreeing with the suggestion of electrolytic action offered in the paper.

Industrial

The Fundamentals of Industrial Distribution Systems. By **D. S. Beeman** and **R. H. Kaufmann** (both General Electric).

Analysis of relative merits of radial, selective and network system for a 3,600-kva. (10 va. per sq.ft.) industrial plant load. Tables of comparative costs. Conclusion is "that the secondary selective circuit arrangements should find general, if not universal, application" for all but the most exacting requirements.

Electrical Drives for Wide Speed Ranges. By **G. A. Caldwell** and **W. H. Formhals** (both Westinghouse).

Rototrol (rotating regulator) superposed on conventional variable-voltage system gives speed range of 120 to 1. Offsets 3 percent residual field and voltage.

A Static Voltage Regulator Insensitive to Load Power Factor. By **C. M. Summers** and **T. T. Short** (both General Electric).

Holds output E within 2½ percent for variation of 30 percent in line voltage and 100 percent in load; 3-cycle recovery; efficiency 90 percent or higher for 1 kva. Has separate constant-voltage and constant current elements.

A New Voltage-Regulating Relay Plus Line-drop Compensator. By **H. J. Carlin** (Westinghouse).

Has inherent time-delay due to use of induction-type voltage relay and self-contained compensator with single adjustment.

Purpose of the Beeman-Kaufmann paper, stated therein, to advocate the general adoption of a selective secondary system of industrial plant distribution drew fire from several directions. J. S. Parsons and H. G. Barnett, Westinghouse, pointed out that the secondary network favored by them had not been offered in any such terms, but only as a system applicable to conditions requiring its particular features. Defense of the simple radial system was not lacking either; R. C. R. Schulze, Public Service Electric & Gas, asserted that this system, well built and well maintained, was in his opinion as good as any. This view was corroborated by E. M. Hunter and J. C. Page, General Electric, who said that "the simple radial type of system need not be condemned too severely for poor service reliability if the proper precautions are taken."

Characterization in the paper of the limiter as a "second rate apparatus" was challenged by H. L. Rawlins and P. O. Langguth, Westinghouse. They said that a device

M. W. Smith, Westinghouse; W. A. Lewis, Cornell; A. C. Monteith, Westinghouse

operating by heat generated within itself had long been recognized as the most reliable of over-current protection and they promised future announcement of a greatly improved limiter. C. R. Mason, General Electric, implied that much of present discussion of virtues of systems of industrial distribution was only academic because field information as to the values of reliability and other features was admittedly meager. Somewhat the same feeling was expressed by H. Speight, Westinghouse, in a remark concerning the comparative costs of different systems, the price paid for the electrical distribution being a very small part of the total cost of the average industrial plant.

Fairly recent investigations have shown that short-circuit currents on low-voltage a.c. systems can be readily calculated and that the calculated and measure values agree within usual engineering tolerances, said A. E. Anderson (General Electric).

Utilization Voltage

Utilization Voltages. By **H. P. Seelye** (Detroit Edison).

Discusses history and import of utilization band; summarizes E.E.I. studies, deprecates further upward shift in lamp voltages. Discusses lamps, range elements, toasters, refrigerator and oil-burner motors.

Commending the purpose and the suggestions of Mr. Seelye's paper, C. A. Powel, Westinghouse, said there appeared no good reason for having a single voltage value assigned to a system, although utilization appliances must of necessity be given single-voltage ratings at which their performances are specified.

Editorials

S. B. WILLIAMS, *Editor*

Foresight in War Load Dispatching

MAINTENANCE of electrical supply under war conditions calls for alert operation at all times, but beyond this loom problems of how to handle plants and systems under emergencies of unpredictable character and duration. Blackouts, whether experimental or enemy-initiated, impose many questions bearing upon the dropping and recovery of loads. Sabotage, should it be successful at this or that point, places heavy responsibilities upon personnel to overcome its effects in the shortest possible time. Load shifts, sudden or otherwise, require accurate knowledge of the practical limitations of voltage and frequency regulation, and the handling of interconnections under stress of wartime situations calls for cool heads and high co-operation by all concerned.

Dispatching organizations are studying these problems in order to be prepared if severe conditions arise. Great interest attaches to the rate of falling off of loads in blackout periods, but even more concern is manifested as to the ability of existing hydro and steam installations to take back such loads following the "all-clear." Much thought is now being expended on the best procedure in allocating loads between hydro and steam plants on systems or in areas utilizing both types of station, assuming an emergency. In one organization the preliminary planning is being done on the basis of a rate of recapture of boiler and steam turbine capacity approximating 5 percent of the equipment rating per minute, or full load recovery in a specific instance in 20 minutes. In extreme cases the rationing of feeders may possibly be required in order to protect equipment from too accelerated loading, but operating opinion in some quarters holds that with adequate reserve capacity in plants and/or tie-line facilities, this form of curtailment is unlikely to be general.

It is also encouraging to note provision in some dispatching circles to establish means of carrying on system operations even under such extreme conditions as the severe injury of equipment and personnel resulting from sabotage or bombing at important load-handling centers. Decentralization of dispatching made considerable progress before the war broke out, and where emergency measures have been planned to continue and expand this kind of program by such means as the use of special assignments of dispatchers equipped with system data kits, road maps, portable radio, and transportation facilities to enable them to take over at specified field locations, with routine and emergency station equipment scheduling and personnel set-ups, service maintenance and restoration appear about as well assured as human skill and imagination can arrange for.

Fundamentals of Corrosion

"ADEQUATE protective coatings for pipes, water boxes, pumps, tanks and concrete sumps are something that give the maintenance engineer many headaches . . . the search for better materials continues." So begins an article recently passed by the editors. It might have gone on to include cable sheaths, vault transformers, tower members, substation structures, anchors and what not, and the attitude would probably have been the same—namely, that the tendency is either to take the word of the producer or else to make a limited number of accelerated exposure tests and act upon the comparative results indicated.

The trouble with the corrosion problem is simply that not enough is known about the chemistry of corrosion and of its inhibition. Relative to liquids and colloids, the solid state of most protective coatings presents a rate of chemical transformation which is so very slow as to obscure the familiar reactions of the other more active states. Apparently there has been a strong tendency to let oxidation carry the blame for all the subversive phenomena. But, since either the vehicle or the pigment is usually organic in nature, can the work of microorganisms from water or air be wholly ignored? Can the multitude of variations in purity and composition of raw materials and equally great multitude of variations in their processing and compounding to constitute protective coatings be resolved into an intelligible pattern? With the upset in raw material supplies it becomes more than ever necessary to find a better basis for rating protective coatings than the trial-and-error method of selection which has prevailed among users.

Under governmental auspices, the fundamental corrosion reactions of metal surface-protections are being studied. There is full participation of those engaged in the task of producing the basic materials and those who process them into public products. Exploration will be made of soluble inhibitive salts, of typical colloidal dispersions, of molecular energies of composite films, of film permeability and diffusion. There will be study of primer systems, with particular emphasis on the promise of chromates, of immunity of coatings to metal ion migration and resistance to toxicants. The program also entails a properties-classification of the cellulose compounds, of natural and synthetic resins and of the pigments used with them.

Whenever the results of such an authoritative and organized research become available there is sure to be a great stride forward in protecting exposed utility equipments from the ravages of corrosive degradation.

Power Salesmen Can Help Conversion

LAST SUMMER it was suggested in these columns that power salesmen could bird-dog small manufacturing plants for war material productive capacity. The idea was brought to the attention of the proper OPM officials and a number of utilities were ready to go into action. Nothing happened.

At that time OPM did not have procurement authority, but its successor, WPB, has that authority. There is no time left to get up a big survey of available plants. These small manufacturers have machinery and labor. Where they are not making products essential to war they are finding it difficult to get priorities on raw materials. Shall they be forced out of business or shall they get an opportunity to convert?

Since the power salesmen know these plants and the machine facilities, why isn't it the reasonable thing to do to supply these men with the requirements and ask them to locate available manufacturing capacity? There is nothing now except inertia to hold WPB back. The time for a big plan has passed. Why not take the tools available—the power salesmen—and put them to work in making conversion of the right kind now?

Jewels Nearing Allocation

DOMESTIC production of instrument jewels is being fostered actively to offset the lost foreign supplies. American manufacturers of synthetic jewels will, in a very few months, be enough in excess of military requirements to afford some margin for replenishing the civilian stocks that will by then be well depleted. The War Production Board is also promoting the use of substitutes such as the glass Vees already produced or used by a few electrical manufacturers.

Nevertheless, month to month allotments will be the rule after March 1.

What will be the effect on the watt-hour meter field? First, the manufacturers appear to have good supplies on hand; second, assurance has been given that meters for utilities will be taken care of, from the jewel allotment angle; third, considering the high unit pressures to which the jewels and pivots and balls are subjected, there is small prospect of substituting glass or other plastic material for the crystal minerals, whether natural or synthetic. Nor is it at all likely that the old magnetic suspension will be revived to afford a complete escape from the bearing problem.

Admittedly, the ball type bearing does make the situation more difficult for a producer or user short on stock. The reason is that it takes two jewels for one required by pivot bearing. However, it does not appear at the moment that the jewel situation is likely to remain critical long enough to disturb the proportions of pivot and ball bearings.

Utilities can do much to protect themselves by doing everything feasible to conserve jewels and to salvage them. Exponents of meticulous refinement of jewel technique may have to yield for the moment to those of an expedient turn of mind—those who can regrind a crystal down to a new bearing surface, such as jewel mounters and finishers. Meter manufacturers should not be bothered at this time with such trifling jobs.

Alternate Safety Specifications

ALTERNATE specifications to apply during the war emergency have recently been set up by Underwriters' Laboratories. Electrical and other products embodying these specifications, with their permissive replacements of scarce materials by others more easily obtainable, will soon be in common use.

It may be taken for granted that the allowed replacements of materials will not impair the ideals of safety so long and so vigilantly maintained by the Laboratories. But what is "safety"? The word itself is indefinite; it is not a term of exact and fixed meaning. The meaning changes with the times; it changes as knowledge grows of the causes of untoward events; it changes also with the conception of the area of possibility of hazard.

The sizes and the numbers of safety factors incorporated in electrical products are related less to the use of those products than to the possibilities of their misuse and abuse. Carelessness and ignorance are the elements of hazard most largely guarded against. The harder, more demanding, conditions of war time, the inability to obtain things so easily as before, should make people more careful with what they have and can get. There will be a heavier obligation on the user to exercise care.

It may also be taken for granted that in this intelligent approach by the Laboratories to the realities of emergency necessities there will be no lowering of operating standards of electrical products. They will work as well as before. The only difference will be that the American public will have to get used to "nickel-plated" products instead of the "gold-plated" ones to which an abundant peace economy has accustomed them.

Although the permissive replacements and reductions now allowed by the Laboratories are stated to be temporary for the "duration," it can be anticipated confidently that some of the alternate materials and practices will become permanent. Knowledge of the performance of these alternates may show them to be as good and as acceptable as those they replace; in fact, it is possible that the changes now and later made may result in better products with improved performance. It wouldn't be the first time that change which seemed at first to be retrogression was discovered later to be in the direction of progress.

But there is another side to this action by the Laboratories that must not be overlooked. We will use substitutes, but we will not use them indiscriminately. We will follow the rules and use only that which is safe and which will perform.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

WPB Settles the Argument

THE War Production Board's decision in the Arkansas aluminum plant power imbroglio is distinctly not a victory for the New Deal public power trust. It can be turned into one some day—and certainly every effort can be expected in that direction—but for the war period its significance lies in the required integration of public and private power capacities for the greatest total generating potential.

This is really the second time J. A. Krug and his Power Branch staff have brought about a merging of public and private generation to meet a war emergency. The Southeast power pooling program of last year was mapped without regard to the ownership of the facilities.

The time factor probably played as big a part as any in the outcome of this Southwest pooling. The question of providing interim power for the aluminum plant at Lake Catherine, Ark., dates back to last June. But it was not until mid-December that Donald M. Nelson gained dominant authority to order things done.

Liked Neither One

At that point there were two proposals under consideration for bringing energy from the north (Kansas and Missouri) and west (Oklahoma) to Lake Catherine. One was the plan of REA's "holding company" cooperative, Ark-La, for a line from Pensacola Dam to Lake Catherine, using Grand River hydro power as firm energy; the other, the utilities' proposal to serve the plant from company-owned reserves via Riverton, Kan.; Norfork, Ark., and Little Rock, with Pensacola power transported free, if the government wanted it, into Lake Catherine from the south, via Tulsa, Waleetka and Ashdown.

Neither plan was adopted.

Instead, WPB's Power Branch recommended, and Nelson directed, construction of a line from Riverton to Lake Catherine, via Pensacola, so that the government hydro station would be tied up with all branches of the huge pool which the companies had created. This was REA's route, except for the Riverton-Pensacola link, and because it was its route it gets to build the line.

But operation of Pensacola is to remain in the hands of the Federal Works Agency and is to be synchronized so as to use the plant primarily as a peaking station for the utility base load steam generators.

Better Integration

WPB's Power Branch engineers feel that Pensacola will be more valuable if tied to all parts of the pool, rather than only to the systems contributing energy from south (Texas, principally) and west of Lake Catherine. They also feel that this provides a better distribution of the reserve capacity combined in the pool.

The utility engineers wanted the Riverton-Norfork-Little Rock line with an eye to the peaking potentialities of Norfork dam, which the Army Engineers will complete next year. Power Branch engineers today feel that Norfork power will not have to be linked with the Southwest pool at all during the war, that this energy will be sent east into the Southeast pool, over existing lines.

This integration of Pensacola with the utility pool is by no means the way REA and the public power trust planned it. They counted upon the Pensacola-Lake Catherine line to provide them with the first link in a transmission and public power generating station grid which ultimately would become the Arkansas Valley Authority.

They are, even now, falsely interpreting the WPB decision as placing the stamp of approval upon their scheme. They can be expected to continue their tactics of grasping at every straw to make their dream come true, either through passage of the Ellis AVA bill or by *fait accompli* behind the cloak of war necessity.

It can, and should, be stated, however, that WPB is not fostering any such program during this war period. Several REA proposals, as well as earlier utility proposals in connection with this aluminum plant, were ruled out prior to the final decision. REA once proposed a 1,500-mile transmission grid hooking up all public power developments in the Southwest to serve this plant. Later this was modified to a plan calling for several hundred miles of line, together with REA-financed and "holding company" operated Diesel and steam generating stations.

This singles out the question, then, of why the utilities were not directed to build the Riverton-Pensacola-Lake Catherine line. Except for the fact that REA proposed this route and the companies had played their chips on another, there perhaps is no satisfactory answer. It might be worth considering that had WPB ordered the companies to build over the REA-proposed route, the political screams of the public power trust would surely have created a crisis for Nelson's newly won authority.

More to the point, perhaps, would be the fact that the public power trust was actively and energetically attempting to turn every development to its advantage, while both WPB and the Defense Plant Corporation, which is building the aluminum plant, felt that the utilities were "too little and too late"—that they anted chips each round only to call.

Grabbed the Opportunity

When it was decided to add a fourth pot line to the Lake Catherine plant, increasing for a short period the interim power requirements by 32,500 kw., the public power trust engineered the seizure of Pensacola dam and REA rushed in with its offer to provide the additional energy. The utilities also offered to increase their commitment, but they so hedged their proposal that at one point, after a long afternoon of discussion, Jesse Jones caustically remarked that it appeared to him they were more interested in "self-defense" than "national defense."

Jones is no friend of public power. Whether or not his remark was justified, it is indicative of the attitude of Nelson and the WPB in negotiating for the materials needed in war production.

NEWS OF THE WEEK

No Curtailment Expected in Regular Lamp Supply

Incandescent lamp manufacturers state that, in accordance with WPB expectations, reduction in use of critical supplies will be effected without affecting volume of regular supply

A limitation order curtailing use of nickel, brass and copper used for manufacture of incandescent bulbs has been issued by the War Production Board. However, WPB's electrical appliance and consumers' durable goods branch expects that the reduction in nickel, brass and copper will be absorbed in elimination of non-essential lamps and substitution of less critical materials rather than curtailment of the volume of regular industrial and civilian types.

75-80 Percent

During February, March and April, and each succeeding three-month period, manufacturers may use only 75 percent of one-fourth the amount of nickel used in producing bulbs in 1940, and only 80 percent of the brass and nickel. In each period the amount of such materials permitted for production of Christmas tree lights or for advertising, decorative or display purposes is limited to 50 percent of one-fourth the 1940 consumption. After February 1 no material obtained on a priority rating may be used in producing Christmas tree lights or advertising, decorative or display bulbs.

In forecasting immediate future of the lamp business, in view of recent governmental rulings, an official of the Hygrade-Sylvania Lamp Company advised ELECTRICAL WORLD that "naturally our first desire and objective will be to cooperate with the government in every way, and it is our feeling that this can be done without serious impairment to general lighting needs.

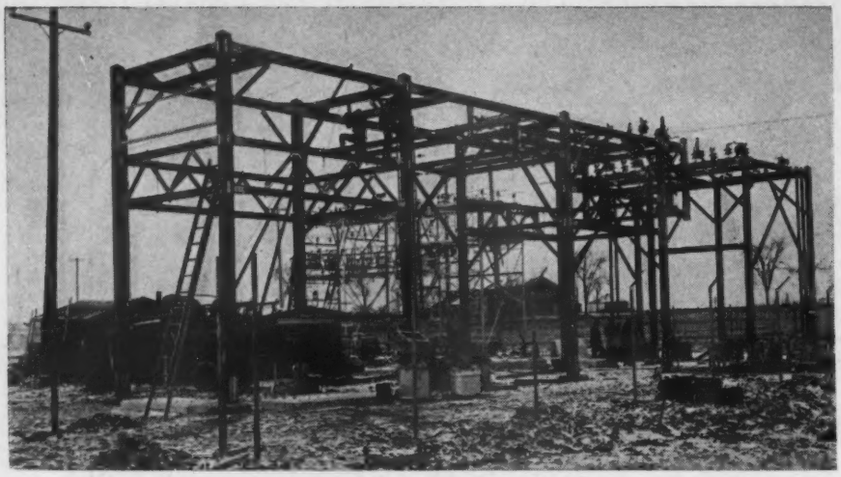
"It is indicated that in many cases substitution of alternate materials will be of substantial assistance in carrying out this program. It seems quite likely that a number of types not required for essential usage may be eliminated. While the manner of accomplishing some of the objectives of the recent pronouncements from Washington is not clear in detail, nevertheless means will no doubt be found to bring this about.

"It goes without saying that the industry will do its utmost to carry the program out effectively and that wholesalers will abide by the restriction of a maximum 60-day stock in carrying on their business. Such cooperation is necessary if the manufacturers of lamps are to be in a position to do their best in providing for the use of new materials and at the same time preserving lamp quality at its present high level."

J. E. Kewley, vice-president of General Electric Co., wired that: "WPB order on limitations of materials for incandescent lamps will be carried out by (1) substitution of less critical materials; (2) more economical use of allotted critical materials, and (3) elimination of non-essential lamps. As implied in the government order, General Electric Co. plans to make lamps available for the essential industrial and civilian needs of its customers."

An official of Westinghouse Lamp Co. advised ELECTRICAL WORLD that "substitution and conservation of metal to

POSITIVE ALARM—To insure that employees on different floors of its office building hear air raid alarms regardless of outside conditions, the Boston Edison Co. has installed sirens in elevator well locations. In other utilities sirens have been attached to elevators which will run up and down, bringing warning to all floors



WOODEN SUBSTATION STRUCTURE—Wartime shortages of steel direct particular interest to Consumers Power Co.'s new Black River substation near Zeeland, Mich. Structure is of Douglas fir pentachlorphenol impregnated. Timbers measure 5½ x 9 in.

meet the war shortage of brass and copper will enable Westinghouse to produce sufficient lamps for all essential demands in 1942. Production of lamps used for advertising display and decoration has already been cut drastically. Engineers have been working for several months to make substitutions possible without impairing the light output and efficiency of Mazda lamps. Alternate materials have been selected only after hundreds of tests have proved that they were the best available for the purpose."

In brief, conferences this week with responsible representatives of the lamp manufacturers lead to the conclusion that (1) they will cooperate fully with the government's wishes and at the same time (2) utility companies and lighting personnel need anticipate no curtailment of ordinary lamp supplies.

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Priority Order for Arkansas Utilities

An A-1-a priority order has been granted to the public utility pool headed by Arkansas Power & Light in order that pool facilities may be made available to an aluminum plant under construction at Lake Catherine, Ark.

The "southern" lines covered by this latest priority order extend from Overton, Tex., to Lake Catherine, via Marshall and Ashdown, together with a short link from Riverton to Neosho, in Kansas.

Previously the WPB had given an A-1-a priority to an REA holding company cooperative line extending from Riverton to Pensacola Dam to Lake Catherine (ELECTRICAL WORLD, January 31, 1942, page 6). However, the state commission in Arkansas advised WPB officials that the REA line would traverse wild and thinly populated country and mountains, would be exposed to sabotage and severe weather conditions, and that therefore priorities should be extended to an alternate "northern" line located in the Riverton-Aurora, Norfork-Little Rock area.

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Mercury for Lamps Under Limitation

Continued supplies of mercury for fluorescent lamps at 100 percent of either 1940 or first-quarter 1941 levels (at the manufacturer's option) is permitted under Priority Order M-78 sharply restricting use of mercury in non-war production.

The order limits to 50 percent of the base period to March 31 and bans entirely after that date use of mercury in a number of civilian products, including non-industrial wall switches.

The order does not provide priority assistance to manufacturers in getting supplies. Instead it merely establishes limits on use for specific purposes.

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Indiana Utility Will Add to Facilities

Enlargement and strengthening of the Southern Indiana Gas & Electric Co.'s service facilities in Mt. Vernon to meet the increasing demands for energy in this territory are in progress, the company has announced.

A new 36-kv. transmission line is being built from the power plant in Evansville to the Mt. Vernon substation. This will supplement the 36-kv. line that is now in service between these two points. New transformers of larger size are being installed at the substation.

NEWS BRIEFS

THE THIRD LARGEST CITY in the United States, Philadelphia, held its first long-planned blackout this week, which was pronounced "nearly" perfect as many war plants, acting under instruction from the War and Navy departments, kept working and were not blacked out.

BOTTLENECK NOWADAYS for utility sales departments is not the major appliances, say a number of our utility informants. Many a utility still has a good supply of appliances in stock, but the difficulty comes in securing the wiring and devices necessary for the house circuit.

POWER SALES ENGINEERS will be interested in knowing that the Division of Contract Distribution is on the way out. Trouble was DCD had no authority to award contracts to small business, or to anybody else. In the end the small business man had to tackle Army and Navy procurement personnel to get any business.

DEFENSE LIGHTING SPEAKERS at the A.I.E.E. meeting last week said that the army is not interested in external blackouts anywhere except within a 300-mile zone of the Coast lines. If this is correct it would appear to be a waste of time, effort and money for any inland city to have blackouts.

DESPITE ALL THE INFORMATION reported from Army sources suggesting the elimination of blue lights in blackouts, Mobile, Ala., has passed an ordinance permitting a certain number of 30-watt blue lights for commercial and residential uses behind a blackout. It is proper to permit lighting behind the blackout, say the experts, but why insist on only one color and one wattage.

NEW ORLEANS ALSO is issuing blackout booklets, under the sponsorship of OCD, which recommend use of 10-watt blue lamps in residences and low-wattage blue lamps as protective lighting in yards and along fences, etc. (!)

THE 1,490 EMPLOYEES of the Indianapolis Power & Light Co. have entered a 100 percent subscription for $34,244 in defense bonds, according to Wallace O. Lee, vice-president of the company.

CONSTRUCTION OF THE Grand Coulee Dam east powerhouse, future home of nine of the world's largest hydro-electric generators, has been started, the Bureau of Reclamation has recently reported.

Ceilings for Wire, Cable and Cable Accessories

Maximum prices fixed at October 15, 1941, levels, to be determined from manufacturers' price lists and discount sheets — Lower than maximum prices permitted

Formal price ceilings on wire, cable and cable accessories were established this week by the Office of Price Administration. With the exception of products containing lead and of weatherproof wire and cable, maximum prices established are those in effect as of October 15, 1941.

The price schedule, identified as Schedule 82, supplants the informal "freezing" request issued by OPA last October 29, after initial conferences with manufacturers.

File Price Lists

Manufacturers of products covered by the order are required to file with OPA by February 20 price lists and discount sheets in effect on October 15. The order requires that these prices be the highest charged in the future, with the exception of wire or cable containing lead and weatherproof wire. New products must be priced on cost computations in effect on October 15.

Products containing lead may be priced at the October 15 level plus an amount equal to the number of pounds of lead multiplied by $0.00325. This, OPA stated, covers about 50 percent of the increase in lead prices approved recently; manufacturers are expected to absorb the rest of the increase.

Maximum prices for weatherproof wire must be computed by applying the terms and conditions contained in each manufacturer's price list in effect on October 15, to a base price of 17.5 cents per pound for solid, soft-drawn, weatherproof copper wire and cable, shipped in less than carload lots. This increase of 2.375 cents per pound is permitted in recognition of the special competitive situation existing last October in cotton yarn prices.

OPA emphasized that the 50 percent allowance for increased lead costs is tentative, subject to modification after study of manufacturer's costs and profits. OPA also stated that requests from the industry for higher prices for armored conductor cable also are under consideration.

Products specifically included in the price "ceilings" are: Rods, bare wire, weatherproof wire, magnet wire, nonmetallic sheathed cable, paper power cable, rubber-sheathed cord and cable, rubber power cable, building wire, asbestos-insulated power cable, varnished cambric-insulated power cable, telephone and telegraph wire, telephone, telegraph or signal cable, special purpose communication or signal wire and cable, armored conductors, shipboard cable, flexible cord and cord sets.

Cable accessories also covered by the order include cable and sealing devices or parts thereof, including potheads, cable terminals, cable terminators, bells and junction boxes, unit packages for splicing and miscellaneous materials used with joints for splicing.

The order specifically permits inclusion in a contract of provision for price adjustment on products called for and made more than nine months after execution of the contract, provided that no adjusted price may exceed the maximums. Less than maximum prices are permitted.

The maximums do not apply to any contract entered into by a manufacturer prior to November 1, 1941, nor to government contracts in existence prior to January 30, 1942.

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New York Conditioning Installations Lower

During 1941 a total of 869 air-conditioning installations, aggregating 9,816 hp., were placed on the lines of the Consolidated Edison Co. of New York, as compared with a total of 1,267 installations and 17,925 hp. in the previous year.

Included in last year's total were 1,049 self-contained air-conditioning units accounting for 2,597 hp. of the total. Corresponding figures for 1940 were 1,389 units and 2,673 hp.

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State Report Urges St. Lawrence Power

Rationing of electric power in up-state New York manufacturing areas "in the near future" is foreseen by the Power Authority of the State of New York. This can partially be alleviated, it is said, by a "gigantic enlargement" of the St. Lawrence program, according to a report this week delivered to the Legislature.

Power rationing, it was stated, would mean restricting the number and size of lights in homes, the use of radios, refrigerators and other household appliances, elimination of electric signs and store window lights, curtailment of power for farms, blacking out many street lights and allocating off-peak power to non-essential industries and businesses.

By next year the up-state shortage is estimated at 350,000 kw. more than the New York City surplus, and a blackout of the Great White Way and rationing of New York City customers was termed "probable."

A prompt start on the St. Lawrence power project was urged with the claim that, with a start this spring, six 45,600-kw. generators would be on the line in 1945 and six more in 1946.

It was recommended that the New York City-Massena transmission line be completed at once to serve the aluminum plant under construction by the government at Massena, N. Y., and utility companies are accused of underestimating power demands during the past two years.

TIME OUT AT A.I.E.E.—After-the-sessions conference at A.I.E.E. winter convention attended by (left to right) W. R. Brownlee of Commonwealth & Southern, J. Elmer Housley of the Aluminum Company of America, J. J. Torok of Corning Glass and C. P. Mills of Mica Insulator Co.

Speakers Deplore Oversold Lighting

Ira Steele, vice-president of the Des Moines Electric Light Co., warned lighting men recently that the sale of lighting should be limited to what the customer can use effectively and efficiently. He warned also against exaggerated and rosy promises of increased business to commercial customers from relighting.

Speaking before the Nebraska-Iowa chapter of the Engineering Society, Mr. Steele said that many potential sales have been killed when a customer has become dissatisfied as the result of being sold more lighting than he could effectively use.

A. E. Smiley, president of A. E. Smiley and Co., Kansas City contractors, urged utility and manufacturers' lighting engineers to bring the electrical contractor into the I.E.S. Organization of an adequate wiring section of the I.E.S. in Kansas City for contractors, jobbers, utility men and others, he said, has resulted in a unification of thought and action on the part of all agencies concerned with the sale of fluorescent lighting, which has improved public acceptance of fluorescent lighting in this city.

Ray Sidele, Grand Rapids Store Equipment Co., in discussing the sale of modern store lighting, suggested that store owners thinking in terms of sales per sq.ft. of floor area be approached by lighting salesmen with unit cost figures prepared on a comparable basis.

E. G. Nichols, Iowa Electric Light & Power Co., found it inconsistent for groups with a common interest within the same industry to be presenting widely different messages to the public on the subject of lighting. Nichols urged the contractors, manufacturers, jobbers, utilities and others to agree on a simple unified lighting message and thus end confusion in the public mind about lighting.

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Signature Procedure for P-46 and P-100

In the special Priorities Insert (see ELECTRICAL WORLD, January 10, 1942, page 40) it was pointed out that the rubber-stamped indorsement on P-46 orders need not be signed by a utility company official. This ruling saves utilities considerable work inasmuch as names need not be signed twice on each order.

It is correct that "any one can place a rubber stamp legend on an order," but the power branch of WPB states that the signature on the purchase order is sufficient to establish the utility's liability.

This simplified procedure does not apply, however, to P-100 orders, used for repair and maintenance, nor does it apply to most other industry repair orders. On these orders the indorsement legend must be manually signed in addition to the signature on the purchase order (see ELECTRICAL WORLD, January 10, 1942, page 41).

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Truce Forgotten in Public Power Drive

On two fronts the New Deal public power trust's drive to set up an Arkansas Valley Authority in the Southwest is moving forward without regard to the public-private power truce ordered last fall by the Administration's defense agency.

Henry W. Blalock, former member of the Arkansas Public Utilities Department, now with the Federal Power Commission, has been loaned to the Rural Electrification Administration to plan ways of developing rural industry in Arkansas by utilization of public power. His assignment follows close upon the reintroduction in both houses of Congress of revised AVA legislation designed to satisfy all factions of the public power trust.

Blalock's assignment is to find ways of tying rural co-operative industrial programs with energy generated at government-financed power projects—energy which the War Production Board intends shall be merged with utility generation to provide a maximum output potential for war needs (see page 62, this issue).

"Extending the benefits of the low-cost power which is available through the federally financed projects to localities now without electricity should result in the economic advancement of the farmer, to the establishment of rural industries and to the betterment of the social and educational situation of the entire community," said REA Administrator Harry Slattery, in announcing Blalock's mission.

The new AVA legislation, which is supposed to have the President's blessing, provides for a $10,000 administrator appointed by the President (without Senate confirmation) and a five-member board also appointed by the President (without Senate confirmation) for four-year terms with authority to formulate major policy. Territory embraced by the measure is the drainage basin of the White, Ouachita and St. Francis rivers below Hutchison, Kan.—104,670 square miles, compared with TVA's 40,500. All existing or future dams built in the area by the Army engineers would be turned over to AVA, which would also have authority to issue $250,000,000 in bonds, acquire utility systems and sell distribution lines to public agencies, and to fix resale rates in wholesale power contracts.

•

Utility Seeks to Build New Power Plant

Ohio Public Service Co. has asked federal permission to construct a new plant to cost between $7,000,000 and $8,000,000 at Dilles Bottom on the Ohio River near Bellaire. The application also requests authority to construct a harbor, ice breakers, unloading docks and pump house.

The plant is proposed to relieve the heavy load on the company's power facilities in the fast-developing northeastern Ohio district, said E. L. Franklin, vice-president of the company, with headquarters at Warren.

INFORMATION PLEASE—Question and answer group, with utility people competing against manufacturers, was a feature of the Des Moines meeting of Iowa-Nebraska I.E.S.

Northwest Companies to Continue Wartime Job

President McKee of Pacific Power & Light says Bonneville schemes to upset experienced and efficient public service organizations "won't help Gen. MacArthur's besieged troops"

Opposition to the reported plan of the Bonneville Power administration to seek between $200,000,000 to $250,000,000 of government funds or from private sources to buy out Pacific Northwest utility systems has been voiced by Paul B. McKee, president of Pacific Power & Light Co.

The Wartime Job

"Reported efforts of Bonneville Administrator Raver to promote some kind of a 'super-corporation' to buy out our properties will not be permitted to divert our energies from the really important wartime job of supplying electric service to more than 125,000 users," President McKee stated.

"My own frank opinion is that any scheme which would upset experienced and efficient public service organizations at this time is wholly contrary to the public interest.

"Certainly a trade in ownership of the electric systems of the Pacific Northwest isn't going to supply more planes and ammunition to General MacArthur's besieged troops, because it won't add a single pole or piece of wire to what is already here," he declared.

Postpone Politics

President McKee said that he and his associates in two local public utilities saw no point to disruption of their systems and "hoped common sense and unity would be served by shelving political power controversies for the duration."

Companies involved in the present controversy include Pacific Power & Light Co., Puget Sound Power & Light and the Washington State properties of Northwest Electric Co. The properties of Washington Water Power Co. are not now being considered for the pool, it was said, but all of the companies named are important bulwarks in West Coast territory understood to be an official combat area in the war.

Present plans to buy out the utility companies are a continuation of a campaign under way before Pearl Harbor which was marked by threats to disconnect the power supply from Bonneville to Portland General Electric Co., unless the public utility company signed a new power contract containing an agreement to sell out its Woodburn, Ore., and Clark County properties (ELECTRICAL WORLD, December 20, 1941, page 8).

Bonneville did not "pull the switch," but is now serving the load on a day-to-day basis. Meanwhile executives of principal Pacific Northwest properties have assembled to pool their resources for the duration of the serious emergency precipitated by the war and planned to link forces with municipal power plants and federal power projects.

•

Synthetic Jewels Proposed for Meters

A concerted campaign to develop American manufacture of synthetic jewels for meters and other industrial uses to replace lost foreign supplies has been launched by the War Production Board.

Current schedules indicate that by mid-1942 domestic jewel production will pass military requirements and permit allocations for essential civilian uses. Meanwhile, present stocks of jewels processed in this country have been "frozen" by Priority Order M-50 pending inauguration of a complete allocation plan on March 1.

Surveys by WPB's Miscellaneous Minerals Branch show that meter companies have supplies of jewels on hand sufficient to meet requirements for a number of months. Between use of substitutes and allocations of existing stocks, WPB officials state that supplies will continue to be made available for utility meters, as a top-notch civilian requirement.

Meter manufacturers have been urged by WPB to investigate availability of substitutes and to make every effort to conserve their jewel supplies. They have been asked to write utility companies urging against installation of new jewels except where the old one is broken or cracked.

"If the jewel is only scratched or rough," the letter says, "it can be polished in either your shop or theirs (the utility's). No jewels should be discarded that can possibly be used."

An instance of substitutes for jewels cited by WPB in another letter to all sapphire jewel users is the glass Vees now being produced by three American companies, Weston Electrical Instrument Corp., General Electric and Richard H. Bird & Co., Waltham, Mass. Bureau of Standards tests show that the glass models are satisfactory both as to friction and wearing when not subject to extreme shock.

The M-50 order bans all sales, transfers, purchases, deliveries and receipts of jewels which have been processed in the United States until March 1, except on orders rated A-1-j or higher or after obtaining specific permission from WPB. By mid-February suppliers of such jewels are required to report to WPB their stocks and requirements for March, from which allocations will be made for that month.

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Geist Named to Direct Allis-Chalmers Sales

W. C. Buchanan, president Allis-Chalmers Manufacturing Co., has announced the appointment of Vice-President Walter Geist as head of a new department to formulate sales policies and co-ordinate and unify selling activities complicated by the company's war effort.

"The matters of sales and sales organization," Mr. Buchanan said, "have become complex because of the company's all-out war effort, which puts practically its entire productive capacity at the disposal of the Army, Navy, Air Corps and the vast number of manufacturers producing material vital to our war efforts. The resulting problems make necessary this new centralized sales administrative department."

•

Opens 40,000-Kw. Plant

Union Electric Co. of Missouri opened this week a new steam-generating power plant designed to add immediately 40,000 kw. to the St. Louis area. The new plant, on the Mississippi River opposite downtown St. Louis at Venice, Ill., is the first step in Union Electric's $33,000,000 war construction program, which, according to company officials, will add 240,000 kw. of new generating capacity to the system's power pool by the end of 1943.

•

Illinois Utility Tax

The public utility tax, at the rate of 3 percent of gross receipts, from public utility services brought in $10,776,623 during 1941, State Finance Director George B. McKibbin has reported. All of this tax was paid to the Emergency Relief Fund.

Canadian Society Holds Winter Meet

Canada's electrical power industry was in an excellent position when the war started to give aid to the important business of producing munitions and is striving in every way to make that aid increasingly effective, McNeely DuBose, president of the Canadian Electrical Association, told 250 delegates at the association's annual winter convention held recently in Montreal.

"With foresight and courage, Canada's utilities increased the amount of power, so that when the war started we had practically 1,000,000 hp. available for war industry," Mr. DuBose stated. "With this as a start we have been able to make the amazing increase of 22 percent during the year 1941 in the amount of power consumption in Canada. This was largely drawn from a more intensive use of existing apparatus, but not entirely, for last year electrical equipment was installed for an additional 250,000 hp. . . ."

J. K. Wilson, chairman of the Public Utilities Wartime Workshop Board, outlined undertakings of the electrical industry throughout the country in connection with the "bits and pieces" program and the placing of workshops at the country's disposal for the training of technical men.

Organized into nineteen committees, the delegates went into business sessions to discuss various technical questions relating to the electrical industry, and particularly having to do with meeting the new demand arising because of war conditions.

One committee, under E. Gray-Donald, Quebec Power Co., on industrial power and heating, spent most of its time on the discussion of means of increasing services of the electrical power suppliers to war industries. Another committee, on lighting, under W. H. Thompson, took up the question of how blackouts and other war conditions are likely to affect lighting in the Dominion during the coming year.

In addressing this committee on conditions on the Pacific Coast, W. C. Mainwaring, general sales manager, British Columbia Electric Railway, said in part: "Practically all large businesses and industry have made necessary arrangements for very quickly blacking out their premises and operating if necessary under complete blackout regulations. The most generally adopted plan has been to paint windows in factories and business buildings on the inside with a black paint preparation, or, alternately, to make plywood covers that can very quickly be installed if the signal is given for a blackout. . . . There are no porch lights, outdoor signs or outdoor lights being used at the present time, although, on account of the high increase in accidents experienced when street lights were put out, we have not yet resorted to discontinuance of street lighting. . . ."

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Edison Day February 11

President Roosevelt has proclaimed February 11 as Thomas Alva Edison Day, in honor of the inventor, who was born in a small Ohio town 95 years ago that day.

MEETINGS

Edison Electric Institute—Transmission and distribution committee, Hotel Cleveland, Cleveland, Ohio, February 9-11; accident prevention committee, William Penn Hotel, Pittsburgh, Pa., February 23-24; annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 23-27. Major H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 9-12. A. H. Parsons, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Midwinter meeting, Palmer House, Chicago, Ill., February 16-20. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

Pennsylvania Electric Association—Electrical equipment committee, Essex House, Newark, N. J., February 19-20. H. A. Randall, chairman, Duquesne Light Co., 435 Sixth Ave., Pittsburgh, Pa.

North Central Electrical Industries—Biennial electrical convention week, Radisson Hotel, Minneapolis, Minn., February 22-25. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

American Society for Testing Materials—Committee week and spring meeting, Hotel Cleveland, Cleveland, Ohio, March 2-6; annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Greater New York Safety Council—Annual safety convention and exposition, Pennsylvania Hotel, New York, N. Y., March 3-6. Greater New York Safety Council, Lincoln Bldg., 60 E. 42nd St., New York, N. Y.

Canadian Electrical Association—Western members, joint meeting with Northwest Electric Light & Power Assn., Business Development Section and Commercial Section, Vancouver, B. C., March 4-6. B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal.

Southeastern Electric Exchange—Engineering and operating section, Sir Walter Hotel, Raleigh, N. C., March 12-13. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Oklahoma Utilities Association—Annual convention, Biltmore Hotel, Oklahoma City, Okla., March 23-24. Miss Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

American Society of Mechanical Engineers—Spring meeting, Rice Hotel, Houston, Texas, March 23-25. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Missouri Valley Electric Association—Annual engineering conference, Hotel Continental, Kansas City, Mo., March 26-27. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

Midwest Power Conference—Annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles A. Nash, conference secretary, Illinois Institute of Technology, Chicago, Ill.

Missouri Association of Public Utilities—Annual convention, Jefferson Hotel, St. Louis, Mo., April 14-15. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

Electrochemical Society—Spring convention, Hotel Hermitage, Nashville, Tenn., April 15-18. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

Association of Iron and Steel Engineers—Spring conference, Royal Connaught Hotel, Hamilton, Ontario, Canada, April 27-28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Chamber of Commerce of the United States—Annual meeting, Washington, D. C., April 27-30.

TVA-Utility Power Pact Cancelled

Justin R. Whiting, president of the Commonwealth & Southern Corp., has announced that the Tennessee Valley Authority has served notice of cancellation of its contract, for supplying 62,500 kw. to the southern utilities of the Commonwealth & Southern Corp., to be effective at midnight on August 14, 1943.

Mr. Whiting pointed out that at the time the eighteen months' cancellation provision was written into the agreement in 1939, eighteen months was considered a reasonable time within which to construct steam capacity to provide energy in place of that purchased. Now, because of the war, manufacturers require at least thirty months within which to deliver new facilities even if available.

"Since the making of this contract it is fortunate that these companies," Mr. Whiting said, "have completed construction and put into service 140,000 kw. of steam generating capacity. They have now under construction an additional 220,000 kw. of generating capacity of which 180,000 kw. is scheduled for completion before the cancellation of this contract becomes operative. The remaining 40,000 kw. of additional steam generating capacity will be put into service within a few months thereafter.

In commenting on the cordial relations which have existed with TVA, Mr. Whiting said: "We have considered that the provisions for interchange between the TVA and these companies whereby substantial savings to both parties resulting from the operation of steam economy and the salvage of what would otherwise be waste water are an important feature of the relationship. We have under consideration at present the negotiation of the continuance of this arrangement for interchange so that these advantages may be preserved in the interests of the Authority and these companies."

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Craig Heads Metermen

Arthur B. Craig, Boston Edison Co., has been elected president of the New England Meter Engineers, Howard G. Laselle of the Narragansett Electric Co., Providence, R. I., becoming vice-president. Harry C. Rankin of the latter utility is secretary-treasurer, and Stafford J. King, Sangamo Meter Co., Boston, has been made manufacturers' representative in the organization. The executive committee includes Kenneth E. White, Central Vermont Public Service Corp., and Arthur W. Weeks, Boston Edison Co.

Output Continues in Normal Zone

The amount of electrical energy distributed by the electric light and power industry for the week ended Saturday, January 31, was 3,468,193,000 kw.-hr., according to the Edison Electric Institute, a recovery of some 28,000,000 kw.-hr. above last week, which is, however, devoid of any particular significance.

The recovery failed to top the 3,472,000,000 kw.-hr. mark set January 10 (see table below), and accordingly the normal springtime decline seems to be continuing, with further impetus to be expected beginning tomorrow, when "wartime" daylight saving goes into effect on a nation-wide basis.

The output continues its course in the zone 14 to 16 percent above the figures of a year ago, and again the Pacific Coast division leads all others in percentage increase, with Rocky Mountain and New England divisions as runners-up.

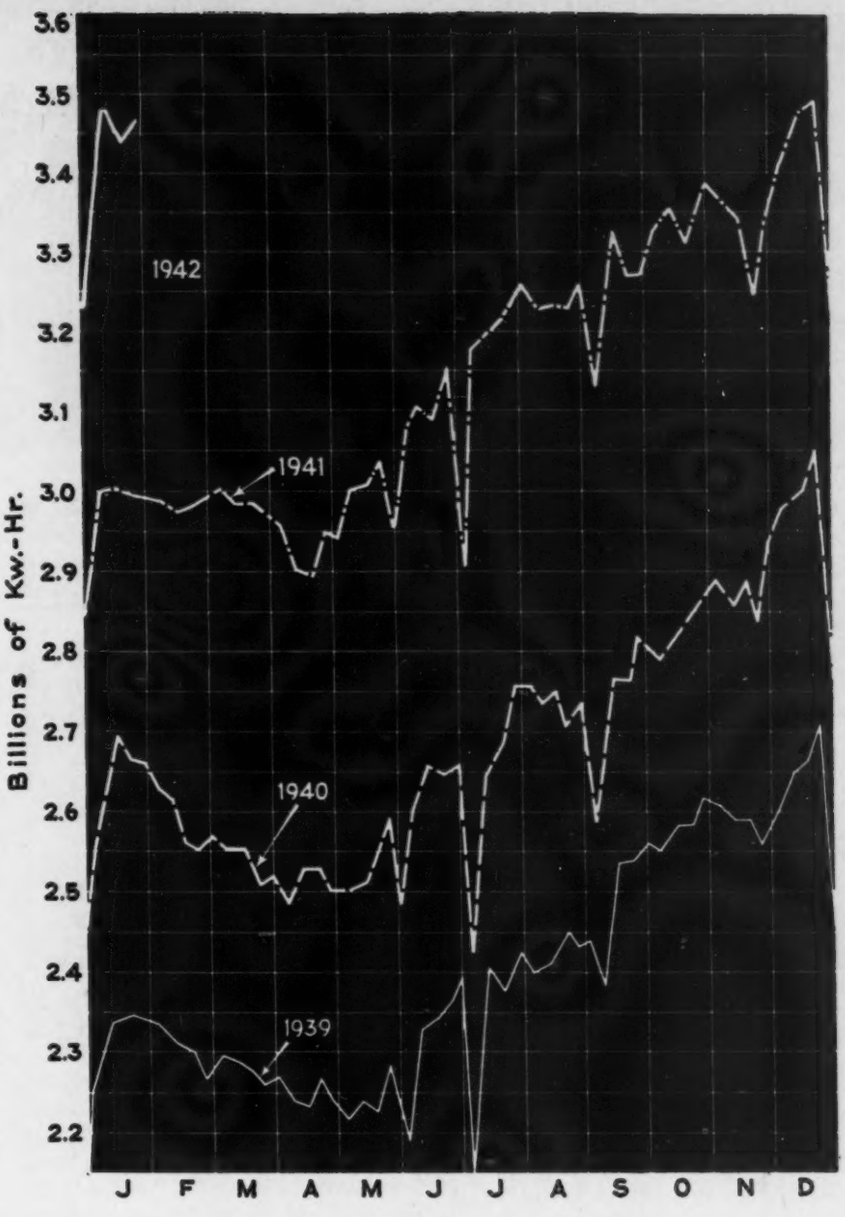
Weekly Output, Millions Kw-Hr.

1942		1941		1940	
Jan. 31	3,468	Feb. 1	2,994	Feb. 3	2,633
Jan. 24	3,440	Jan. 25	2,996	Jan. 27	2,661
Jan. 17	3,450	Jan. 18	3,013	Jan. 20	2,674
Jan. 10	3,473*	Jan. 11	3,002	Jan. 13	2,688
Jan. 3	3,289*	Jan. 4	2,846	Jan. 6	2,558
1941		1940		1939	
Dec. 27	3,234	Dec. 28	2,757	Dec. 30	2,464
Dec. 20	3,495	Dec. 21	3,052	Dec. 23	2,712
Dec. 13	3,476	Dec. 14	3,003	Dec. 16	2,674
Dec. 6	3,415	Dec. 7	2,976	Dec. 9	2,654

Percent Change from Previous Year

	Week Ending		
	Jan. 31	Jan. 24	Jan. 17
New England	+18.1	+16.0	+16.4
Mid-Atlantic	+12.7	+11.6	+11.0
Central Industrial	+13.7	+13.2	+12.9
West Central	+12.0	+12.5	+14.3
Southern States	+17.5	+16.9	+15.4
Rocky Mountain	+17.9	+18.2	+15.8
Pacific Coast	+24.8	+21.0	+23.0
Total United States	+15.8	+14.8	+14.5

* Revised.



Energy Production Rises 16.5 Percent

Electric energy produced for public use in December, 1941, totaled 15,353,703,000 kw.-hr., an increase of 16.5 percent over production in December, 1940, according to a report issued by the Federal Power Commission.

Average daily production of electric energy for public use in December was 533,115,000 kw.-hr., an increase of 2.3 percent over average daily production during the previous month. Production by water power in December amounted to 4,477,827,000 kw.-hr., or 29.2 percent of the total output for public use.

For the twelve months ended December 31, the report shows, total production for public use was 164,946,000,000 kw.-hr., an increase of 15.9 percent over production for public use for twelve-month period ended December 31, 1940.

The capacity of generating plants in service in the United States on December 31, 1941, totaled 44,024,219 kw., a net increase of 236,182 kw. over generating capacity reported in service on November 30.

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Energy Requirements Up

Electric energy requirements for November totaled 13,979,565 kw.-hr., a gain of 14.2 percent over the same month last year, according to the report issued by the Federal Power Commission, and corresponding peak demands, up 10.8 percent over November a year ago, aggregated 30,380,721 kw. New generating capacity placed on order during November totaled 220,000 kw. Of this amount, 10,000 kw. are scheduled for operation during 1943 and 210,000 kw. during 1944.

•

Primary Load Up 18%

An 18 percent increase during December of primary load supply is shown by the Ontario Hydro-Electric Power Commission over same period last year. During the month the maximum 20-minute peak horsepower supplied was 2,202,613 compared with 2,864,487 in December, 1940.

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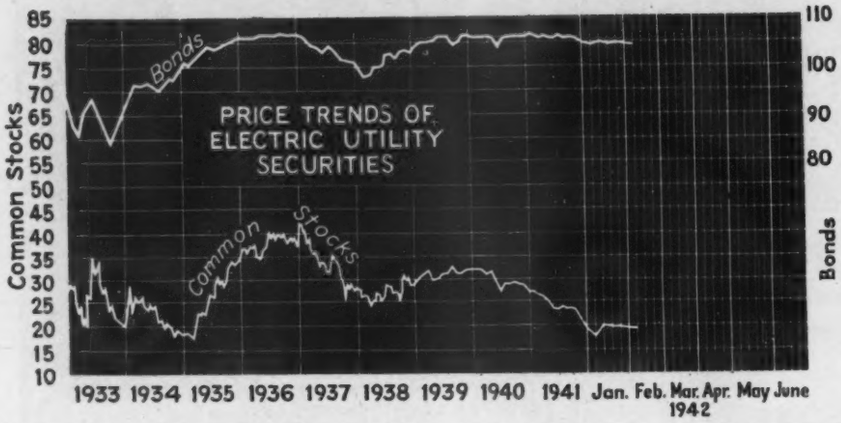
Coulee Output Doubled

With the throwing of a switch, power from the Grand Coulee Dam's second 108,000-kw. generator became available last week, the Bureau of Reclamation announced.

Stock and Bond Prices Turn Upward



Following the general market trend, utility security prices rallied slightly during the past week. "Electrical World" stock index went to 19.8 from 19.5 the previous week; last year, 26.4. Bonds advanced to 104.8; last week, 104.7; last year, 106.1

Has Filed With SEC 2,695,000 Shares

The entire common stock of the Union Electric Co. of Missouri has been registered under the Securities Act of 1933 with the Securities and Exchange Commission.

Comprising 2,695,000 shares, the proposed offering will mark the largest common stock distribution ever made under the Securities Act. The stock, all of which is owned by the North American Co., is to be distributed to the general public through a nation-wide group of investment banking houses headed by Dillon, Read & Co. of New York.

North American has filed an application with the SEC for approval of the program, proceeds from the sale to be applied by North American first to the retirement of its entire outstanding debenture indebtedness and the balance to be used for general corporate purposes.

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Louisville Seeks Competitive Bids

Amending its original application, Louisville Gas & Electric Co. has asked permission of the Securities and Exchange commission to invite competitive bids on securities to finance the construction of transmission lines. It had first sought permission to borrow $3,850,000 from the Reconstruction Finance Corporation through an arrangement involving two subsidiaries.

An official of the company said the approximately 70 miles of transmission lines contemplated were wanted and suggested by the Tennessee Valley Authority so that TVA might get power from Kentucky, Indiana and Ohio plants to help it meet military production demands. He did not specify the type of securities for which bids would be sought.

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Duke Power Passes Million Kw. Mark

The generating capacity, water and steam, of Duke Power Co. will pass the million-kilowatt mark next June, Charles I. Burkholder, vice-president in charge of operations, has announced, when the addition to the Buck steam plant near Spencer is completed and placed in operation. The Spencer addition will add 40,000 kw. and will increase the capacity of the station to 190,000 kw., the largest plant in the system.

The new Spencer unit is part of a large expansion program launched several years ago by the company. The program, now rapidly nearing completion, included the Cliffside plant, two additions at the Buck plant, and an addition to the River Bend plant.

Completion of the program will give the seven steam plants in the system a generating capacity of 542,000 kw. and the water power plants a capacity of 498,413 kw., or a total of 1,040,413 kw.

Mr. Burkholder pointed out that even during the severe drought last year, when Duke reservoirs were at a low level, the company was not only able to produce sufficient power to meet the heavy industrial demands of the Piedmont Carolinas, greatly accelerated by defense production, but had a large surplus available for siphoning into other systems not so fortunate.

FINANCIAL BRIEFS

Securities and Exchange Commission has given conditional approval to the application of the Public Service Co. of Indiana for the sale of $42,000,000 of its 30-year 3⅜ percent first mortgage bonds and $10,000,000 of its serial notes. The condition was that a prior restriction on common stock dividends of the company be increased from $500,000 to $750,000 yearly and from a total cumulative amount of $5,000,000 to $7,500,000 and that the company retire an additional $1,750,000 of its outstanding indebtedness.

TWO SUBSIDIARIES of Consolidated Edison Co. of New York, Inc., have reduced their quarterly dividend payments on common stock, but the parent company declared a regular quarterly dividend of 40 cents a common share. Brooklyn Edison reduced its quarterly common stock dividend to $1.75 from $2 a share and the New York & Queens Electric Light & Power Co. declared a dividend of $1.75, against previous payments of $2 quarterly.

ATLANTIC CITY ELECTRIC CO. has filed with the SEC a registration statement for sale of 62,000 shares of cumulative preferred stock of $100 par value, of which 49,000 shares are to be sold through competitive bidding and the remaining 13,000 reserved for an exchange offer to holders of the company's outstanding $6 cumulative preferred stock.

•

SEC Industry Report

The Securities and Exchange Commission has issued the tenth in its series of industry reports covering the manufacturers of electrical supplies and equipment. The report covers 31 companies engaged primarily in the manufacture of electrical supplies and equipment other than household appliances which had registered securities on December 31, 1940. Copies are available without charge from SEC.

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Houser Succeeds O'Brien

As predicted in ELECTRICAL WORLD last week (January 31, page 20), John W. Houser has been appointed to succeed Robert H. O'Brien as director of the public utility division of the Securities and Exchange Commission. A lawyer by profession, Mr. Houser joined the SEC as an attorney in the utility division in 1938 and recently has been an assistant to Mr. O'Brien.

•

Substation Allotment

Bonneville Power Administration has approved additions to its substation near Walla Walla which will cost approximately $130,000.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Industrial Power

Increase Visibility With Underfloor Duct

Underfloor duct, through which branch circuits radiate from three strategically located power panels to driven machines at the Milwaukee plant of McCulloch Engineering Company, was dictated, at least in one respect, strictly out of consideration for the company's customers.

At one end of the machine shop floor of this new supercharger manufacturing plant a railed, elevated observation gallery has been provided from which vantage point customers and plant visitors can watch production operations without cluttering up the floor or getting too close to certain "special" operations.

To be effective, the view from this gallery had to be unobstructed by conduit drops from overhead circuits —so often festooned with contactors and controls. To accomplish this, underfloor duct used is being tapped at the individual machines and risers brought up to controls mounted on the machine frames. Thus nothing obstructs the visitor's view, as testified by the accompanying illustrations.

Beyond this advantage, however, underfloor duct provided the only means available for carrying the number of branch circuits (No. 12 wire minimum) that future conditions were expected to require. Also, ease with which this type duct can be tapped permits ready relocation of machines with changes in the production setup.

Direction of Runs

Underfloor duct carrying power circuits is run lengthwise of the machine bays and is paralleled by separate ducts for supplementary machine lighting. The single exception to the rule against conduit runs overhead in this plant is in the case of fluorescent lighting circuits. These runs are, however, fastened to building steel well above the level of the fluorescent units themselves and do not obstruct the view from the visitors' gallery.

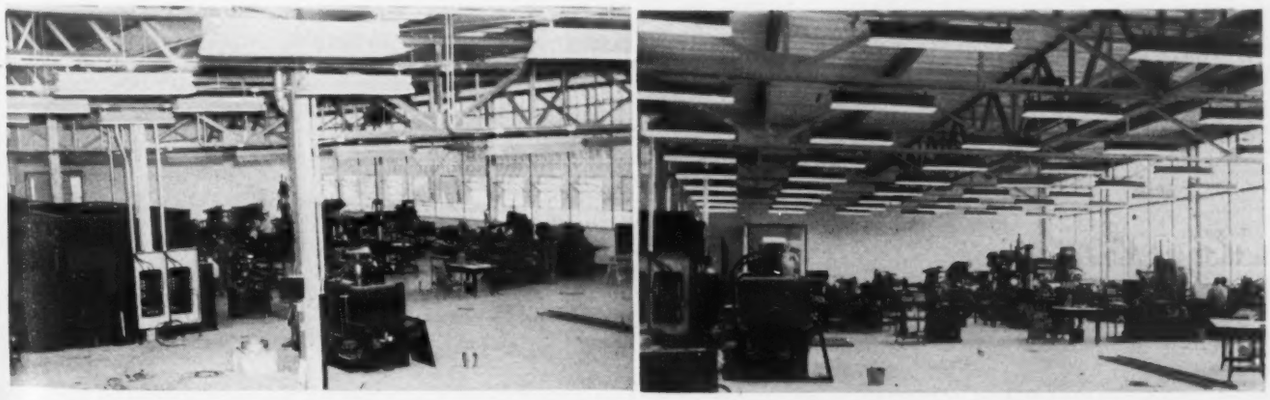
Substations

Compressed Air Supply for Breakers

By R. C. CUNNINGHAM
Switchgear Engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Since the compressed air circuit breaker uses air as an interrupting medium as well as drive for mechanical operation, failure of the air supply would leave the breaker unable to interrupt the current, even if provision was made to open the contacts independently of the air supply.

A compressed air system designed to meet the stringent requirements of a particular breaker is shown schematically in the illustration. The compressor at 70 percent speed, the reserve capacity intercoolers, a valve interlock to prevent pumping to full pressure if the crankcase oil level is low—all these serve to keep the operating temperature low, prevent "flashing" the oil vapors which are always present in the discharge air,



ABSENCE of conduit drops gives visitors clear view of machine shop floor from observation gallery (left). View from machine floor shows complete absence of obstruction. Machine lighting and power circuits are in separate underfloor duct (right)

thus giving positive protection against a "flash" explosion.

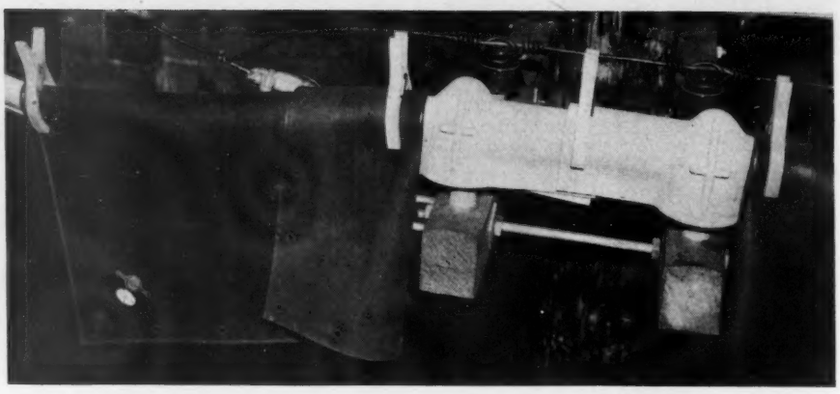
To provide dry air the two-stage compressor feeds through an "intercooler" into an "after-cooler" at 250 psi. where most of the moisture is removed by normal condensation. From the compressor reservoir the air is expanded into the breaker piping system at 150 psi. The compressor reservoir is connected to the individual breaker tanks through a system of cocks, cutoff valves and filters.

The line filters serve only as "back-up" protection against dirt in the air, since there is a dust filter on the compressor intake and, in addition, the moisture precipitation in the after-cooler tends to wash the air.

Two compressors feeding a group of breakers serve the double purpose of increasing the reservoir volume and giving "standby" service in the case of possible mechanical failure of a compressor. Increase in reservoir volume gives air for more than 20 operations after loss or discontinuance of compressor functioning.

Cutoff valves in the supply lines serve as a precaution against air feeding either from an individual breaker to a leaky system or from the system to a leaky breaker. Alarm gages give immediate warning of any abnormalities in the pressure in either the supply lines or the breakers.

Cocks in the main air line provide sectionalizing action to separate the two compressor units and isolate any trouble to that portion of the system in which the trouble may have occurred. In the case of a reduction in pressure at the breaker itself, alarm devices are energized and the breaker may be either tripped, while the pressure is sufficient for interruption, or the contacts "locked in," depending upon the position and the function of the breaker in the electrical system.

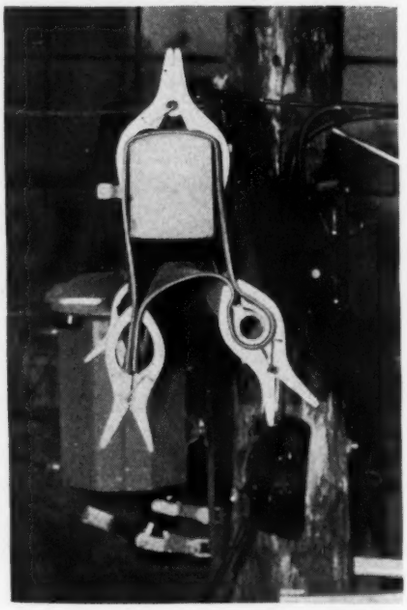


RUBBER BLANKETS and insulator hoods secured in place by clamps

Protection

Clamp Adapted to Line, Substation Use

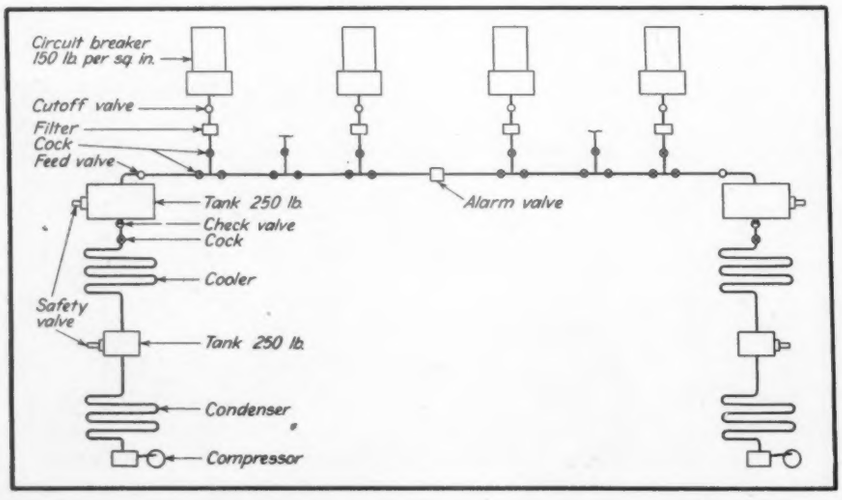
A wooden, spring-controlled clamp for use in connection with protective rubber blankets in distribution work has been developed by D. C. Blackmon, line foreman for the Niagara, Lockport & Ontario Power Company at Olean, N. Y. Mr. Blackmon had designed a clamping device for holding patterns to plywood in his home work shop. While using the clamp, he recognized that it also had possibilities for use as a fastener for protective rubber blankets.



WOODEN CLAMP in three simulated uses

The clamp is made from selected maple stock and is $6\frac{3}{4}$ in. long, with a jaw opening of $3\frac{3}{4}$ in. The gripping effect is secured from a stiff coil spring mounted at the hinge of the jaws. Size and shape of the jaw opening adapts the clamp to a great variety of uses. Some of the conditions where it has been found very effective is in holding rubber blankets on line hose, insulator hooks, cutouts, dead-end assemblies, secondary racks, transformer bushings, etc. It has also proved satisfactory in substation work, where it has been used to hold rubber blankets on bus work, pipe and other structural steel members. Linemen wearing rubber gloves have found the clamp easy to manipulate.

Some of the many applications of the clamp are suggested in the accompanying illustrations.



SCHEMATIC diagram of compressed air supply system for air circuit breakers

SWITCHGEAR FOR YOUR ENTIRE STATION

ALL THIS--
CO-ORDINATED

1. **Metal-enclosed Duplex Switchboards** for centralized control and metering.
2. **Metal-enclosed FH Cubicles** for main power circuits, complete with air-blast or low-oil-content circuit breakers and all necessary primary equipment.
3. **Metal-enclosed Reactor Equipments** for the feeder circuits.
4. **Metal-enclosed Cable Entrance Equipments** for the feeder circuits.
5. **Metal-enclosed Bus Runs** for all primary connections.
6. **Metal-clad Switchgear** for the medium-capacity auxiliary circuits, complete with air or oil circuit breakers.
7. **Metal-enclosed Drawout Air Breaker Equipments** for the low-voltage auxiliary circuits, complete with circuit breakers, buses, interconnections, and interlocks.

SELECT IT ALL at one time
INSTALL IT ALL as a unit
THIS means—

- ★ A single transaction—one company responsible
- ★ Speedy, easy installation at a low, predictable cost
- ★ All designed as a single unit—complete co-ordination of all functions
- ★ Simplified over-all station design
- ★ The greatest safety and operating dependability assured by modern, proved equipments

THESE are *standard* switchgear equipments, but they're *tailored* for today's tremendous wartime power and production requirements.

They are the equipments for which our factory is tooled—which we have prepared to manufacture in the shortest possible time.

They are the safest and most dependable equipments we know how to build.

When you select *any one* of these metal-enclosed equipments, you get everything completely co-ordinated, and it's shipped ready to install. You get the savings in installation time and space that go with it.

When you select *a number of*—or all of—these equipments, you get more of the same savings in time and space, *plus* an extra degree of over-all co-ordination that may make possible a simplification of your entire station design. Ask your G-E office for further information, or write to General Electric Company, Schenectady, New York.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of ordnance.

GENERAL ELECTRIC

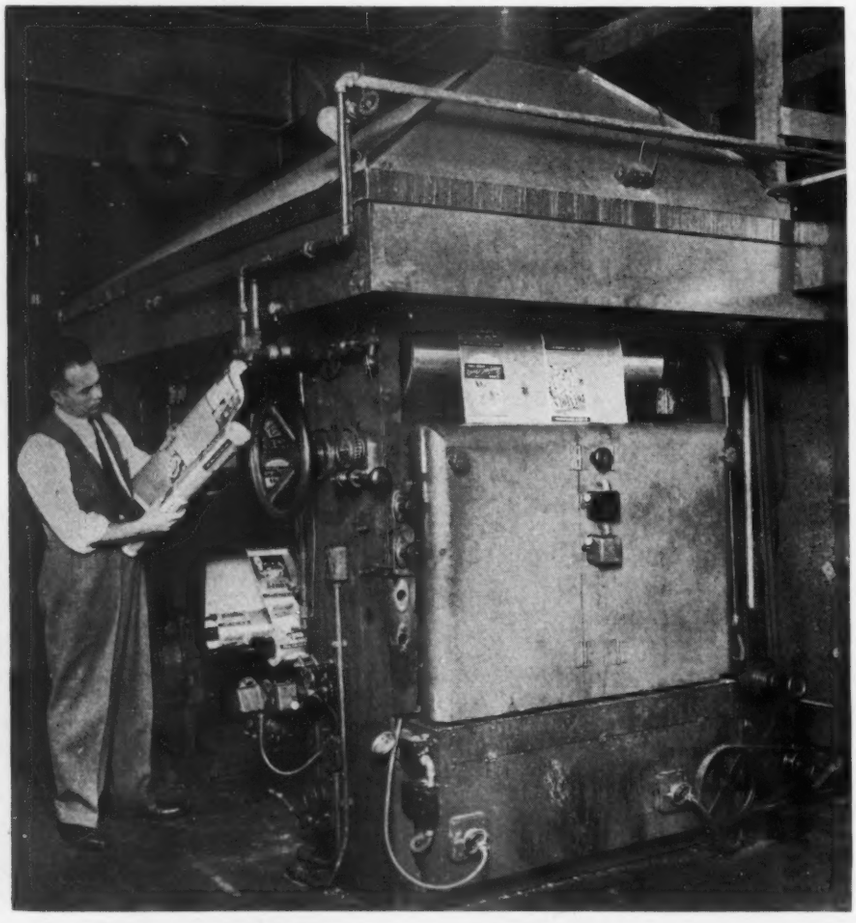
Industrial Heat

Electric Heat Aids in Applying "Hot-Melt"

For applying thermoplastic solution (cellulose acetate) to paper, an operation which must take place at carefully controlled temperatures, the Standard Process Company, Chicago, has found that electric heat, thermostatically controlled, is the most suitable. This thermoplastic or "hot-melt," known as "Liquafilm," is used on labels, magazine covers, packages and candy box covers.

The cellulose acetate, which must be applied at a temperature of 280 deg. F., is first heated to a temperature of 275 deg. F. in a tank equipped with six 1,000-watt and seven 500-watt Calrod heaters. The thermoplastic is then drawn into another tank heated by seven 500-watt Calrod heaters to 280 deg. F. Both tanks are located at the bottom of the processing machine.

As the paper enters the machine the coating is applied by a roll which is kept warm by a 250-watt heater. A blade warmed by a 500-watt heater "doctors" the roll. The paper is then contacted by two smoothing and glazing blades, each heated by a 3,000-watt heater.



ELECTRIC HEAT supplied by 24 units, connected load 19,750 watts, keeps thermoplastic at correct temperature for processing cook book covers

Line Engineering

Capacitors for Higher Line Thermal Loading

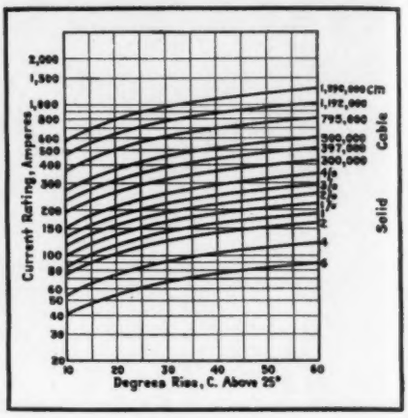
By J. W. BUTLER
Central Station Engineering Department
General Electric Company

Load-carrying capacity of existing transmission lines can be increased by the use of *series capacitors* for line reactance compensation — with the same stability margins and voltage drops as previously obtained—if (a) the conductors have sufficient thermal capacity and (b) the reactive sources at the sending end can supply the reactive kva. requirements of the desired load increment.

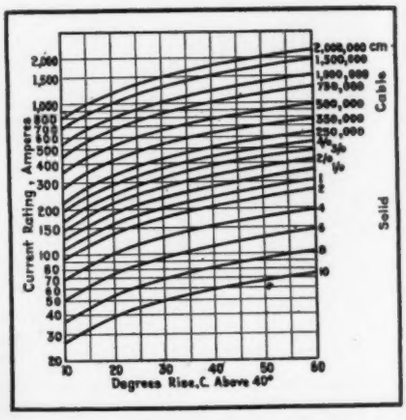
The load-carrying capacity of existing transmission lines can be increased by the use of *shunt capacitors* or *synchronous* condensers if (a) additional reactive kva. provisions have to be made for, and/or (b) the conductors would be thermally overloaded carrying the desired load increment.

Extent to which capacitors can be utilized to minimize the imposition of reactive kva. on the line as a whole and arrive at an ideal of unity power factor somewhere near the middle of the line depends on the current-temperature characteristics of the conductors.

The data given in the accompanying charts are useful in this connection. It is generally felt by wire manufacturers and engineers that neither copper nor aluminum conductors should operate above 100 deg. C. As a dead conductor may reach a temperature of approximately 40 deg. C. in strong sunlight, these curves give current ratings only up to 60 deg. C. rise.



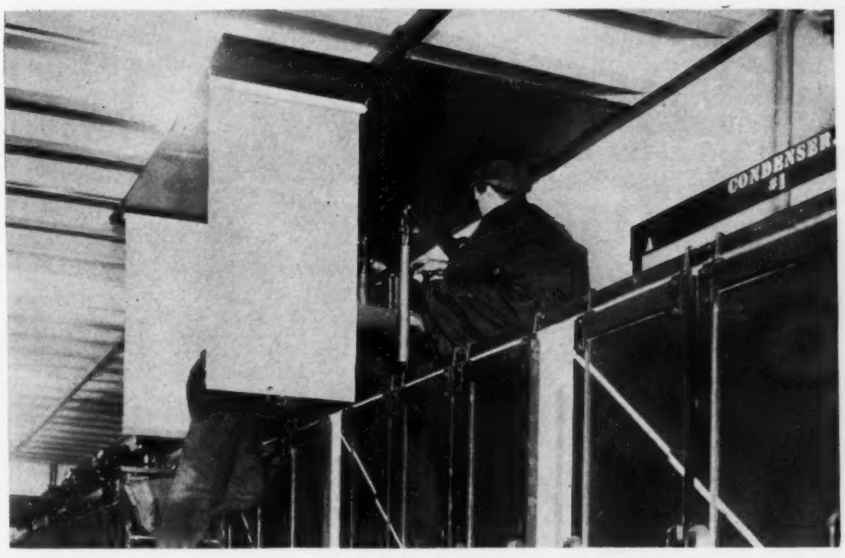
TEMPERATURE-RISE CURVES for ACSR at 60 cycles, still air. Data supplied by Aluminum Company of America



OUTDOOR CURRENT RATINGS of bare copper wire and cables at 60 cycles with cross wind of 2 ft. per second. Data supplied by Anaconda Wire & Cable Company

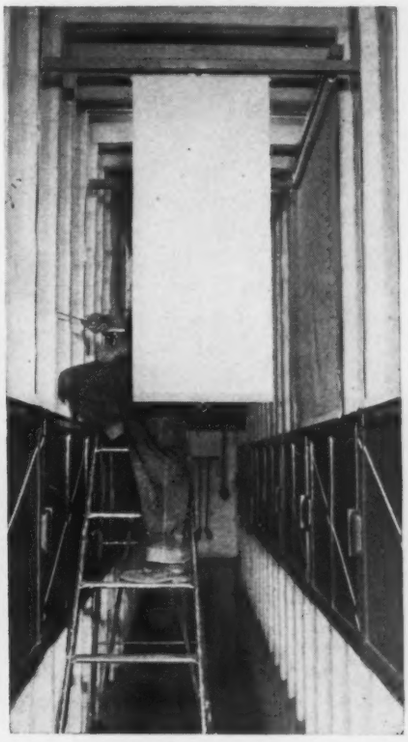
4 SAFETY MEASURES for SUBSTATIONS

Safer substation practices on Brockton (Mass.) Edison Company's system emphasize alertness, isolation, concentration, conferences



FIREPROOF board panel is ¾ in. thick and reinforced by "Homosite"

It slides horizontally along an angle-iron track (2x2-in. section) above circuit breaker operating mechanisms at Dupont Circle; rings provided at ends for switchstick hooks. Carries 4-ft. 6½in.x21-in. fire-resistant roller shades (lowered) while men are working on dead cell section below. Confines attention of workman to immediate area concerned. Breaker cell groups isolated by painting (1) red stripes vertically between groups of these phases, (2) ½-in. wide diagonal white stripes across cell door fronts, generally at a 40-deg. angle with the horizontal. Stepladder braces are also painted red to make their position more conspicuous and insure proper closing before use

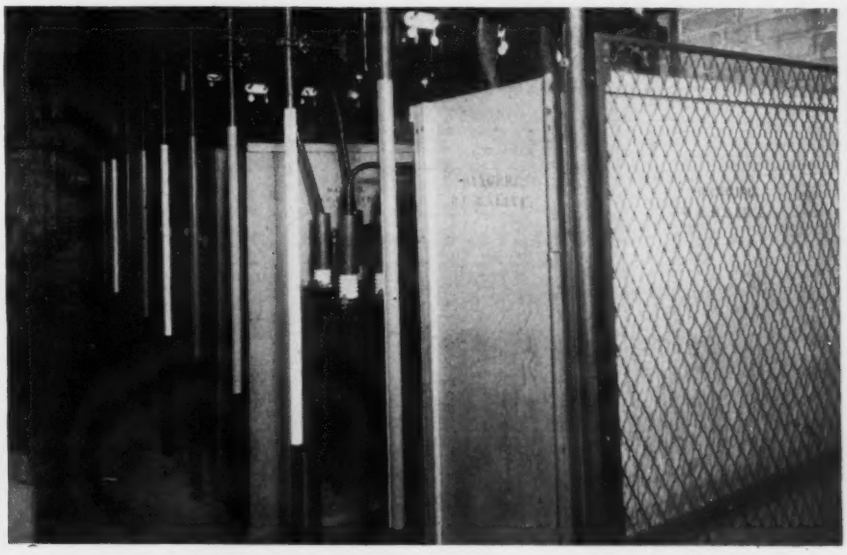


DEMOUNTABLE SHADES segregate workman in disconnecting switch compartments of 13-kv. section

Attached to rollers fastened to 1¾x2-in. red-painted fir cross-frames resting on right-angled pins located in ends of cell barriers; aisle is 4 ft. wide; shade surfaces facing workman are painted red, light cream color outside aisle shades

FIRE-RESISTANT SUIT and hat is donned by S. F. Nolan, load dispatcher, in 13-kv. oil circuit breaker room passageway

Rubber gloves inside asbestos gloves. Eight switchsticks from 4 to 10 ft.; ends of fiber tubing. Red stripes for higher visibility.



SIX-FOOT HIGH sectional barriers of ¼-in. plywood assembled in two minutes inclose two 4-kw. oil circuit breaker units

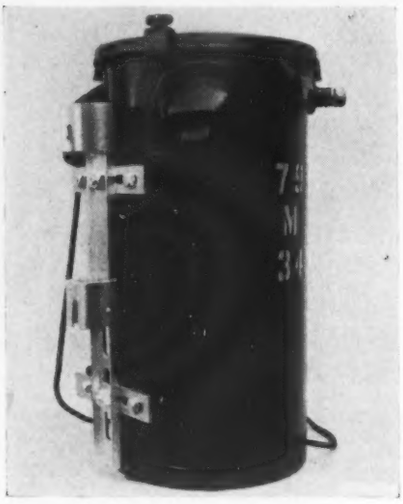
Adjacent breakers similarly inclosed. Painted with insulating varnish; tongued and grooved; hooks and eyes hold firmly in place; 22½ in. wide at front and 40½ in. at side. Vertical pipe racking is black, red, white and orange, so painted that two identical colors always cover the portion of pipe facing given breaker unit

Pole Lines

Adapter Used for Direct Pole Mounting

By FRANK SANFORD
Distribution Engineer
Cincinnati Gas & Electric Company

In arranging to mount distribution transformers directly on poles, the Cincinnati Gas & Electric Company has used an adapter with units formerly designed for crossarm hangers. The adapter shown in accompanying illustrations has been found to fit, with only a few exceptions, all transformers in the 2,400-volt class, up to and including 25 kva. for 12-in. bolt spacing. A similar design has been made for transformers to be mounted on 24-in. bolt spacing. For the present, shop-built hangers are being assembled by welding old hanger iron material to fit individual transformers.



ADAPTER attached to transformer

Several considerations have led to a complete change to direct mounting for all new and repaired transformers to be installed on the company's distribution system. For construction used in Cincinnati:

1. Estimated unit saving for new transformers (with mounting lugs for direct-pole mounting) in new installations is $3.85 for sizes 25 kva. and below.

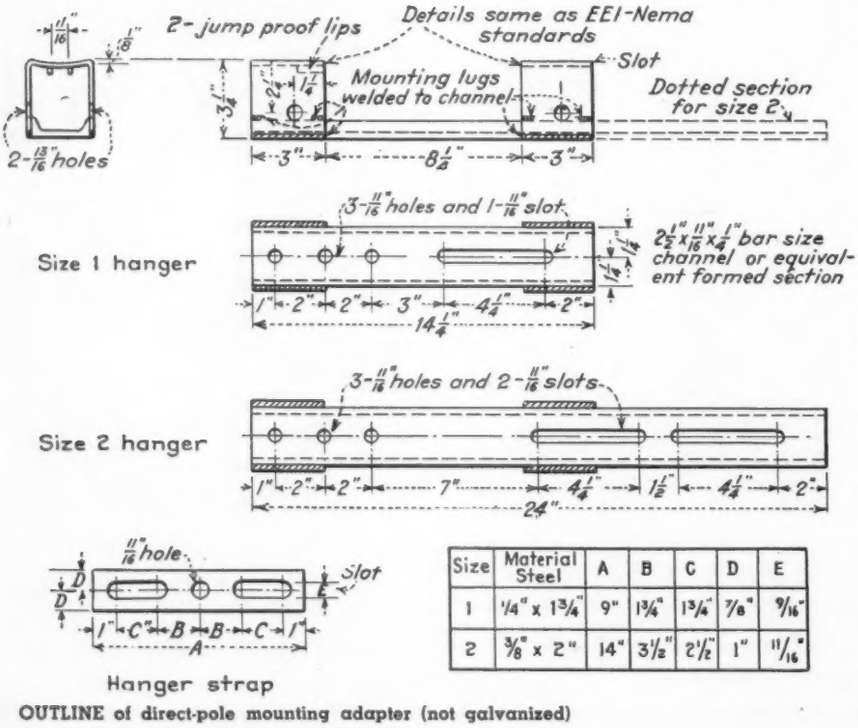
2. For the older transformers, equipped with adapters in the repair shop, the saving for the crossarm and bolts will pay for the new hangers and the cost of changing them.

3. For larger installations of new transformers, where we have in the past used channel reinforcement, the saving will be $8.50.

4. For the larger sizes with shop-built adapters there is an average saving of about $4.

Relative to the foregoing monetary savings, between continuing customary crossarm hanger mounting and changing to direct-pole mounting, the values will be more apparent when the small difference is multiplied by the number of thousands of units involved.

The largest consideration cannot be directly evaluated. In one twelve-month period 187 distribution poles in the Cincinnati system were hit by machines. The exact number of these poles that carried transformers is not recorded, but in fourteen cases outages at the transformer resulted. There are ten or twelve transformers taken to the repair shop yearly that are included in the damage. Usually the transformers remain suspended in the air, in a precarious position, but some drop to the ground.



Size	Material Steel	A	B	C	D	E
1	¼" x 1¾"	9"	1¾"	1¾"	⅞"	9/16"
2	⅜" x 2"	14"	3½"	2½"	1"	11/16"

OUTLINE of direct-pole mounting adapter (not galvanized)

Stores

Outdated Equipment Salvaged for Service

By J. C. HENKLE

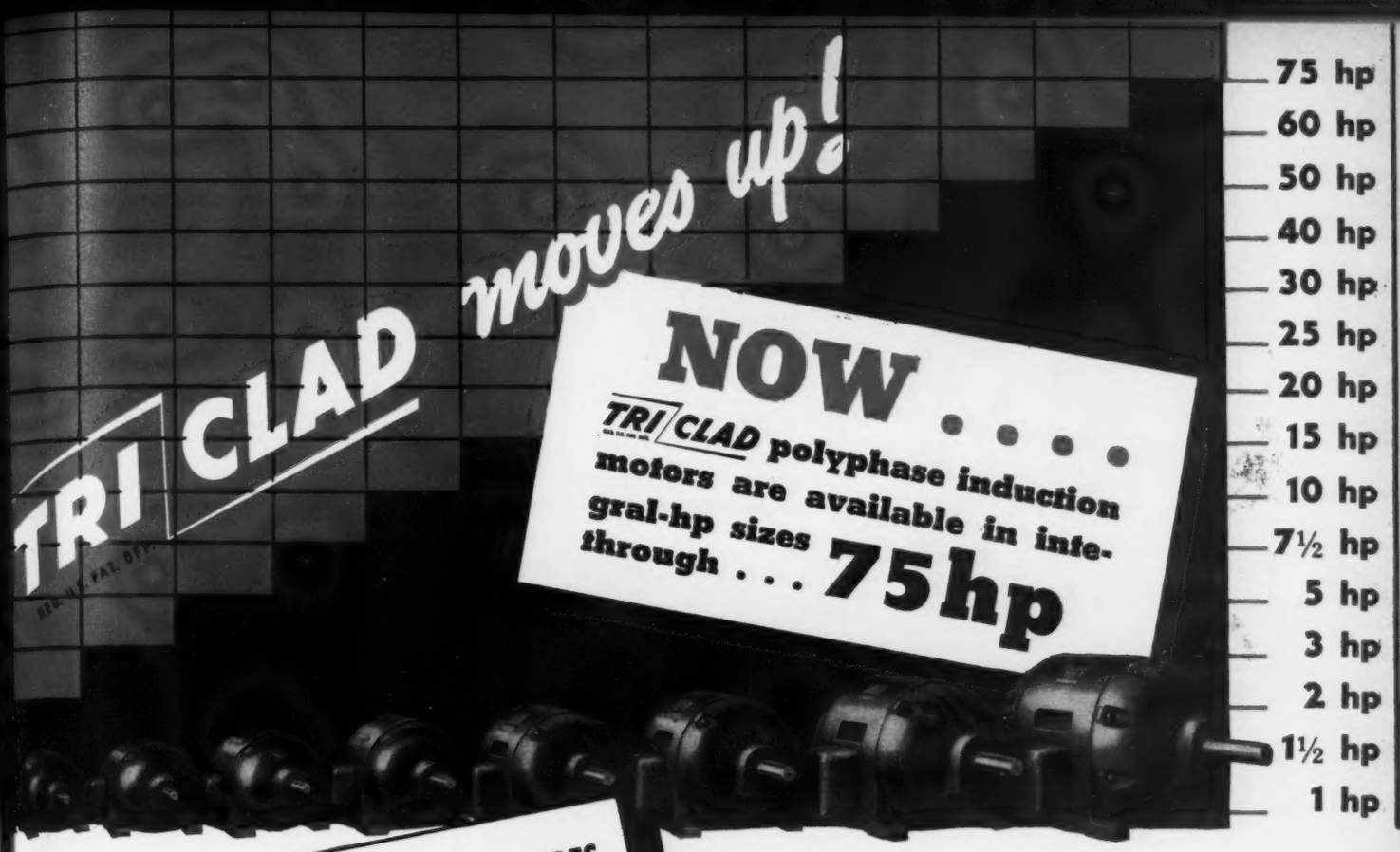
Superintendent E. M. & C. Department, Portland General Electric Company, Portland, Ore.

Rebuilding of outdated equipment or otherwise adapting it to continued service is being systematically carried on by the Portland General Electric Company, as indicated by the following examples.

We had about 15 G.E. type IRS and Westinghouse induction type feeder regulators that had been used indoors but which had been retired because of the installation of regulating transformers. These units have been converted to outdoor use, since in recent years our substations have been of the outdoor type, and now it is becoming increasingly difficult to obtain new equipment for the substations.

Conversion was accomplished by constructing a metal housing of angle and galvanized sheet and attaching it to the regulator frame, thus forming a self-contained, weatherproof unit that can be moved readily from one location to another. These regulators average about 200 amp. each, with 10 percent boost or buck. The list price when originally purchased was approximately $3,000. New equipment to perform the same function now lists at $3,750.

In the case of meters, we follow two well-defined policies. The first, now quite commonly followed, is to take service or house type meters and obtain conversion parts and build socket mountings. The other policy is to



THREE "EXTRA PROTECTION" FEATURES GIVE EVERY TRI CLAD MOTOR . . . GREAT STRENGTH AND LONG LIFE

1 Extra Protection against Physical Damage

ARMORED CONSTRUCTION . . . SMOOTH CONTOURS . . . RIGID ALIGNMENT Strong, one-piece, cast-iron frame and cast end shields, with upper portion completely enclosed, protect vital motor parts from external blows, falling objects, or dripping liquids.

2 Extra Protection against Electrical Breakdown

"FORMEX" WINDINGS . . BONDED COIL UNITS Features for extra protection against moisture, oil, abrasion, and heat-shock.

3 Extra Protection against Wear and Tear

NEW BEARING DESIGN . . . NEW OPERATING SMOOTHNESS Sleeve bearings proportioned and grooved for protective lubrication under severe loads. Sleeve and ball bearings enclosed in strong, dust-tight housings.

a LARGER range of sizes! a WIDER scope of service!

The advanced design and triple-tough construction that won industry's enthusiastic acceptance almost overnight have now been extended to many larger motors in our a-c line.

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

BUILT FOR PROTECTION FIRST . . . TO LAST!

GENERAL ELECTRIC

REBUILT constant-current transformer now adaptable to incandescent lamp street-lighting circuits, being inspected by C. A. Warren, foreman

take old meters of low rating and rewind the current coils so as to make a 25-amp. meter.

We had a large quantity of I-14 and other types of meters from early days, ranging from 5 to 25 amp., on which the overload capacity is nil. Modern meters have an overload capacity and because of this a 15-amp. meter will take care of any house job. But reconstruction of our old meters to 15 amp. would not be sufficient as they still would have no overload capacity. So, to play safe, we rebuilt them to 25-amp., 220-volt, three-wire capacity. This required disassembling, rewinding current coil and making some changes in the gear register in certain instances. In some types it was also necessary to make some magnet changes.

We have rebuilt approximately a thousand meters and before we finish the job several thousands will have been reconstructed. At the same time we are also purchasing new meters, as obtainable. But the rebuilts are satisfactory and are a great help in meeting the present problem.

Also we had some old constant-current transformers as used on arc lamp circuits. The tubes and folderols had been junked. The core and primary were retained and the secondary coil was rewound from 4 amp. to 6.6 amp. for the incandescent street-lighting circuits. We expect to convert some 30 sets that are left, as fast as we can get the luminaires. A new transformer for the purpose costs about $600 or $700, if, as and when it can be obtained. We can rebuild the old ones for about half that price. Furthermore, with the present type of transformer, about 75 lights can be run per circuit. With the rebuilt type we can operate 95 lights per circuit.

Lighting

Adjustable Machine Tool Lighting

At the new factory of the Jacobs Manufacturing Company, Hartford, Conn., a wide range of adjustment of individual fluorescent lighting units is obtained by suspending these fixtures by light brass chains from ¾-in. horizontal rigid conduit runs which carry the supply circuits. In the example shown, a unit composed of two 40-watt Westinghouse daylight tubes in a reflector serves a Cincinnati grinder, a flexible cord being plugged into a receptacle in the conduit. Changes in height are easily obtained by varying the position of a hook at the end of the chain hanger, and in the event of the character of production being modified this simple scheme provides for instantaneous adjustment.

Hydro Plant

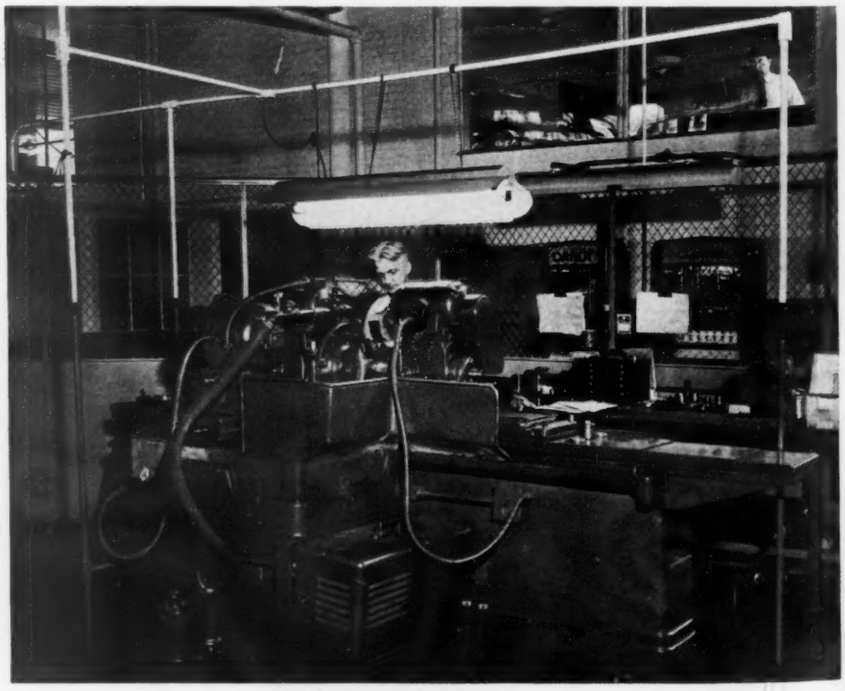
Waterwheel Shaft Reground on Job

By R. J. RUEDY
Engineering Department
General Electric Company, Boston

On vertical shaft units, such as waterwheel driven generators, loss of proper alignment of parts sometimes results in working of the thrust collar on the shaft. In ordinary cases the rotor is removed and taken to some machine shop large enough to swing it in a lathe, true up the shaft, bore out the thrust block and bush it, and rebore the block to the new fit.

Recently, a unit was so located in the station that it was impossible to remove the rotor without practically dismantling the station itself. The only alternative was to grind the shaft in place.

A rig was made up to grind the shaft fit by rotating the grinder around the vertical stationary shaft. The equipment consisted of an upper and lower guide, each with three adjustable brass blocks for centering and maintaining close running clearance. These two guides were joined together rigidly by two pieces of stiff channel iron and so spaced that they rode on smooth portions of the shaft, which were true in accordance with



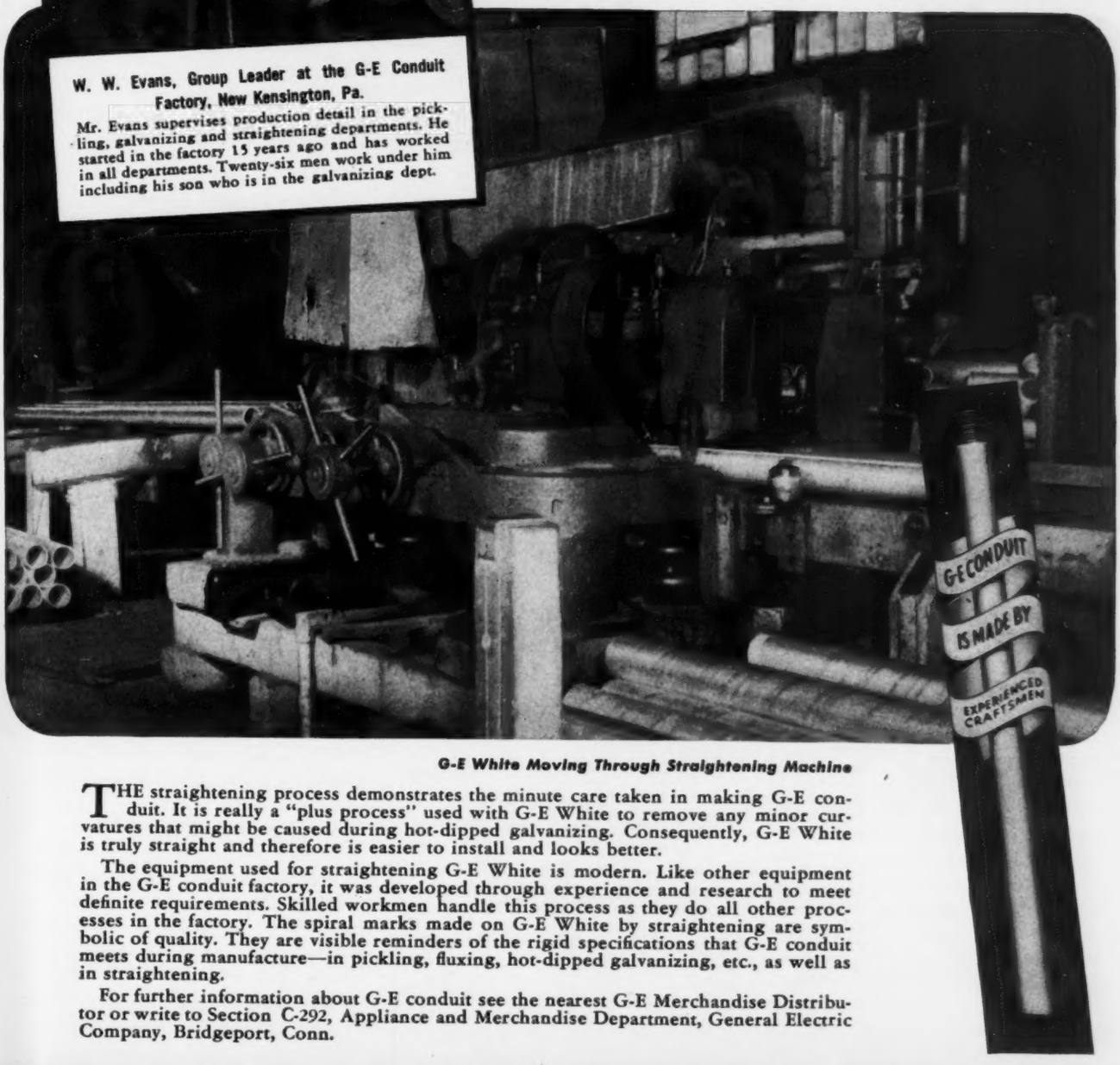
FLUORESCENT FIXTURE suspended by chains is adjustable for height

Every Piece of G-E WHITE CONDUIT Is Carefully Straightened

No. 5 of a Series—Men and Processes Behind G-E Conduit

W. W. Evans, Group Leader at the G-E Conduit Factory, New Kensington, Pa.

Mr. Evans supervises production detail in the pickling, galvanizing and straightening departments. He started in the factory 15 years ago and has worked in all departments. Twenty-six men work under him including his son who is in the galvanizing dept.



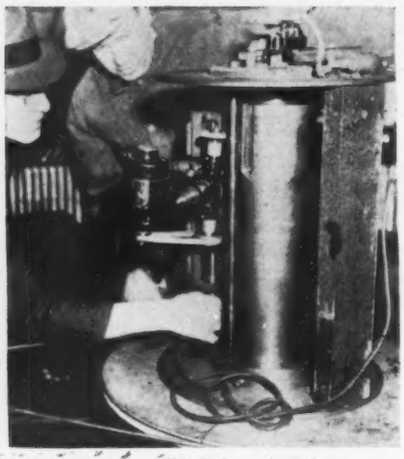
G-E White Moving Through Straightening Machine

THE straightening process demonstrates the minute care taken in making G-E conduit. It is really a "plus process" used with G-E White to remove any minor curvatures that might be caused during hot-dipped galvanizing. Consequently, G-E White is truly straight and therefore is easier to install and looks better.

The equipment used for straightening G-E White is modern. Like other equipment in the G-E conduit factory, it was developed through experience and research to meet definite requirements. Skilled workmen handle this process as they do all other processes in the factory. The spiral marks made on G-E White by straightening are symbolic of quality. They are visible reminders of the rigid specifications that G-E conduit meets during manufacture—in pickling, fluxing, hot-dipped galvanizing, etc., as well as in straightening.

For further information about G-E conduit see the nearest G-E Merchandise Distributor or write to Section C-292, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC



SPECIAL RIG ready to grind shaft worn by loss of alignment

the original machining. On one of the channels a compound tool rest was secured, supporting a small motor-driven grinder with a 2-in. wheel operating at about 13,000 r.p.m.

A 20-in. wooden pulley was secured to the lower guide and belted to a ⅓-hp., 148-r.p.m. gear motor with a small pulley. This drove the rig and grinder around the shaft at approximately 14 r.p.m. The parallel feed of the tool rest was connected to a six-spoke starwheel below the wooden pulley and a stationary pin was located to turn the feed screw one spoke for each revolution of the rig, thereby accomplishing automatic feed of the grinder up and down the shaft. A collector ring from an old single-phase motor was mounted on top of the assembly for power supply to the grinder.

Two days of grinding was necessary to true up the shaft fit satisfactorily by this method. A pin gage was made for the new diameter with allowance for the desired fit. The thrust block, with its bore built up by metal spraying, was ground out to this pin gage.

The thrust block was warmed to about 75 deg. C., which allowed the block to slide in place on the shaft easily.

C. T. Characteristics for Relay Operation

By C. E. LAMPHIER

General Engineering Laboratory,
General Electric Company, Schenectady, N. Y.

Protection

A recent survey of service interruptions on large utility systems revealed that the cause for 12 percent of these failures could be traced to the failure to recognize the ratio errors of instrument current transformers, when subjected to high overcurrents. While this figure seems small, it is, nevertheless, a large percentage when considering that these figures are based on the normal operations of systems where the majority of the circuits have been checked on network analyzers.

There are various methods of testing current transformers to verify the ratio and phase characteristics at values of currents beyond the rating of the devices. The two-wattmeter differential current method, which is now in use in the laboratory of the General Electric Company, has simplified the testing procedure and has facilitated the shipment of orders where the transformer's characteristics are required.

The new method receives its name from the use of the two special wattmeters for reading the ratio and phase angle values. The current source for these instruments is the differential current obtained from the opposition of the test transformer's secondary current to the standard transformer's secondary current. Voltages for the wattmeters is obtained as follows:

1. The voltage (E_r) for the ratio instrument, which is substantially in phase with the standard transformer's secondary current, is produced by the drop across a non-inductive resistor.

2. The voltage (E_x) for the phase angle instrument, which is substantially in quadrature with the standard transformer's secondary current, is produced by the drop across a 0.05-p.f. air-core reactor.

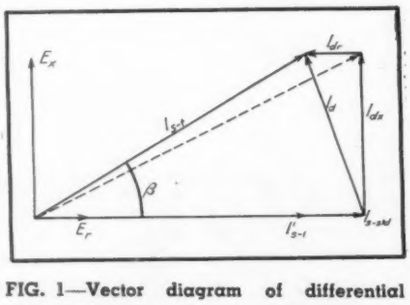


FIG. 1—Vector diagram of differential method of testing current transformers

These values of current and voltage I_d, E_r and E_x are shown on the vector diagram Fig. 1. The current for the above resistor and reactor is obtained from an excitation transformer connected in series with the primary of the standard and test transformers (see Fig. 2).

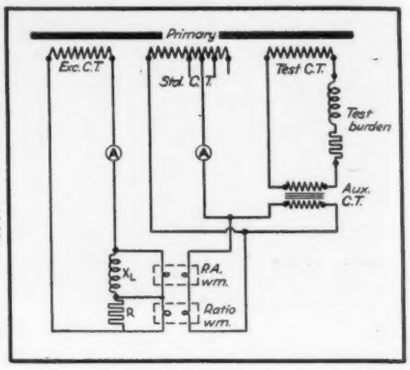


FIG. 2—Schematic diagram of connections

The vector components (I_{dr} and I_{dx}) of the differential current are then calculated from the two wattmeter readings, and the ratio-correction factor (RCF) or ratio of the test transformer's to the standard transformer's secondary current is:

$$\text{Apparent } RCF_{test} = \frac{I_{std.}}{I_{std} \pm I_{dr}} \times \cos \beta$$

Likewise

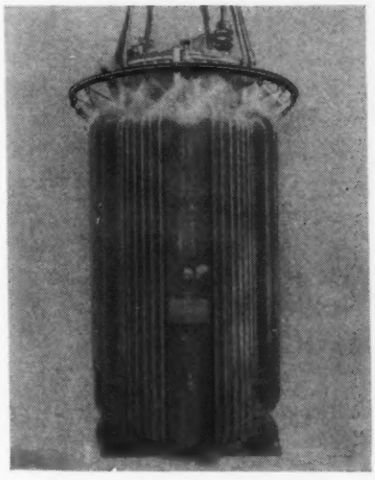
$$\text{Apparent Tan } \beta = \frac{I_{dx}}{I_{std.}}$$

Corrections are made for the errors that are introduced by the assumption that the test secondary current is of a magnitude and phase as shown by the dotted vector of Fig. 1. Also, the ratio and phase angle are mathematically adjusted to compensate for the standard transformer's errors in order to obtain the true ratio and phase angle of the test transformer in relation to the primary current.

The two-wattmeter method has been very successful in applications up to the present limit of 80,000 primary amperes. The 2 percent accuracy is dependent upon the proper selection of ratio values for the standard, auxiliary and excitation transformers in order to obtain reasonable scale deflections on the wattmeters.

The method has greatly reduced the time factor involved during testing, thus preventing thermal damage to the transformer, and at the same time reducing the actual expense of testing.

MORE POWER *from your* TRANSFORMERS *with*



Low Cost
Frost Proof
Self Draining
Easy to Install
Simple to Operate
Highly Efficient

With increased demands on your present transformers and difficulty of obtaining additional units at this time, the BROOKS Spray Ring Cooling System offers a solution to a critical problem.

Efficiency of Transformers

Capacity of Power Transformers, equipped with Brooks Spray Rings, are delivering 60% or more of rated capacity without injury of overheating.

Here's how it functions—

The ninety degree sprayer nozzles are located directly below the header ring and spaced at about 1 foot intervals. Each sprayer has a swivel joint permitting every spray to be correctly directed on the crown of the cooler tubes with proper overlap for sufficient cooling of tubes and tank wall. Spray nozzles are easily removed for inspection. Spray Ring is self-draining requiring no special attention to prevent freezing.

Here's how simple it is to install—

The Header Ring is made of 1¼" heavy copper tubing bent to the contour of the transformer and bolted to iron brackets which set the ring slightly beyond the cooling tubes. This permits use of sling hooks on the transformer and enables transformer to be moved with ring mounted in position.

Water demand and Automatic Control

An ordinary hose supply with a lazy flow of about 15 or 20 gal. a minute is ample. Automatic operation may be obtained with a solenoid valve set off by an alarm gauge when transformers reach point of overheating.

Start now to make your present transformers do more work — efficiently.

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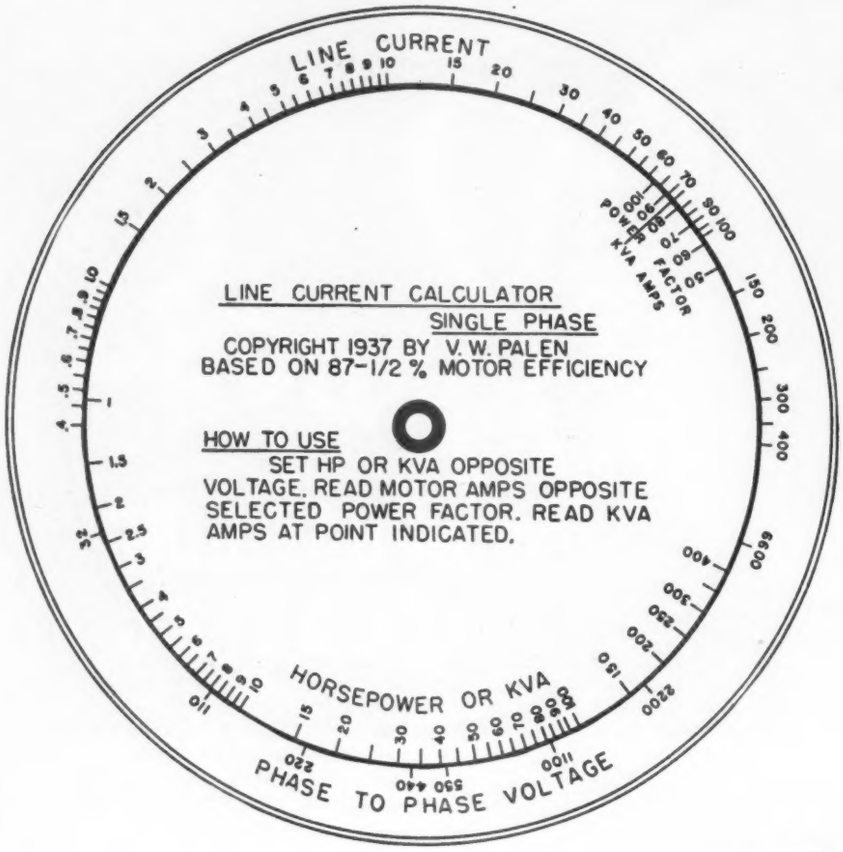
Line Current Calculators*

Line Engineering


LINE CURRENT
POWER FACTOR
KVA AMPS
LINE CURRENT CALCULATOR
SINGLE PHASE
COPYRIGHT 1937 BY V. W. PALEN
BASED ON 87-1/2 % MOTOR EFFICIENCY
HOW TO USE
SET HP OR KVA OPPOSITE VOLTAGE. READ MOTOR AMPS OPPOSITE SELECTED POWER FACTOR. READ KVA AMPS AT POINT INDICATED.
HORSEPOWER OR KVA
PHASE TO PHASE VOLTAGE

Single-Phase: Solves equations:

$$I = \frac{Hp \times 746}{E \times PF \times Eff}$$

for motor line current

$$KVA\ Amps. = \frac{Kva \times 1{,}000}{E}$$

for single-phase circuit (unity power factor)

When

E = Voltage
PF = Power factor
Eff = Efficiency, 87.5 percent assumed

LINE CURRENT
POWER FACTOR
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HORSEPOWER OR KVA
PHASE TO PHASE VOLTAGE

Three-Phase: Solves equations:

$$I = \frac{430 \times Hp}{E \times Pf \times Eff}$$

for three-phase motor line current

$$KVA.\ Amps. = \frac{Kva \times 1{,}000}{1.73 \times E}$$

for three-phase circuit (unity power factor)

when

E = Voltage: across phases
PF = Power factor
Eff = Efficiency, 87.5 percent assumed

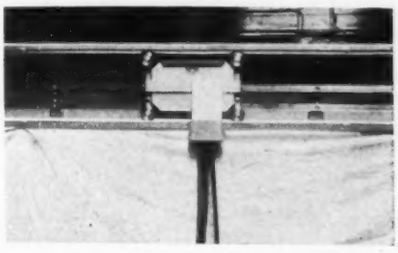
*By V. W. Palen, Northern States Power Co., Eau Claire, Wis. All rights to this calculator are reserved by author.

Heavy-Duty Trolley Bus Service Cranes

Industrial Power

Hazards of exposed trolley wires feeding outdoor or indoor craneways have been eliminated in a new trolley duct development that has successfully undergone trials in West Coast shipyards. Because speed-up production has increased the hazard factor this trolley closure, designed by Charles Barkis, Trumbull Electric Manufacturing Company engineer in San Francisco, has been installed in new yards.

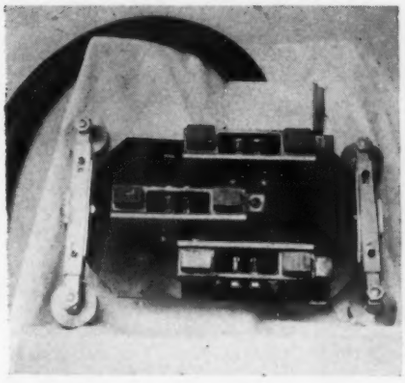
Need for safety protection of crane



"TROLLEY CLOSUR," with cover removed, shows three buses and sliding brush assembly. With cover installed, the system is safe and weatherproof

trolleys came with a requirement that such a craneway trolley should carry 200 amp. at 440 volts, three phase. The closure is constructed in 10-ft. sections of 10-gage steel shaped rectangularly with an open side. This channel is set vertically against the columns and has a cover over the open side to protect the buses from the weather. Copper buses have sufficient size to allow a liberal safety factor and are fashioned so that joints at sections, being offset, provide a continuous path for the double brushes. The double brushes sliding along the bus insure contact and at least one brush is always in good contact. Brushes are held in special spring clamps on an assembly which runs along two angle rails welded to the edges of the housing.

Spring tension on the upper wheels takes up the inequalities in the rail, while the weight is carried on the lower wheels. Adjustment nuts are provided so that after the brush-holder trolley is set in place it cannot jump out.



MULTIPLE brushes, two for each phase, are held in this assembly. Tapered and undercut wheels with oilless bearings support and guide the brush assembly

Leads from the copper-graphite multiple brushes, which are shielded from each other by barriers of insulating material, are brought through flexible connections to heavy rubber-covered conductor leads. These leads loop down below the trolley and are served to the crane motor through customary circuit protection and switching. Provision is made to clamp onto this trolley collector rig so that it will follow the crane along as required. Runs as long as 600 ft. and more operate with perfect conductivity and mechanical smoothness.

Lighting

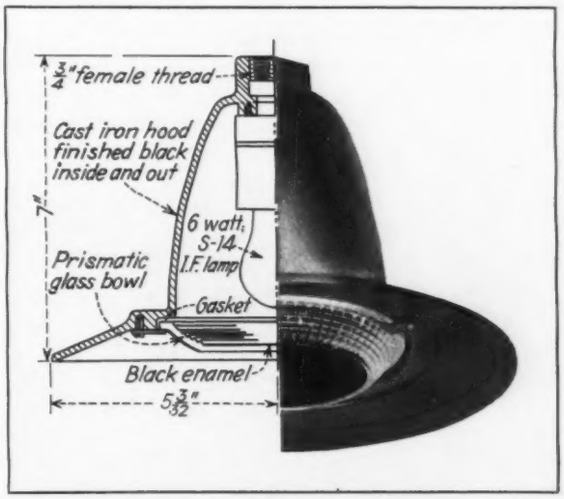
Blackout Light Uses Glass Refractor

The equivalent of star light on a clear night—0.0002 to 0.0004 ft. candles—is delivered by a new blackout lighting unit, using a 6-watt, S-14 bulb. As an added protection against detection of the unit or of the surrounding area by hostile aircraft, the unit is designed so that there will be no light at a vertical angle of 90 deg. and above the fixture.

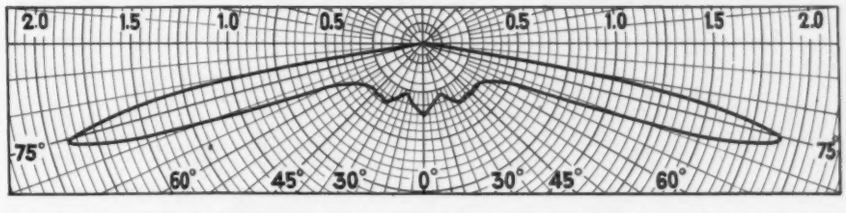
Of the suspension type, the lighting unit consists of a one-piece crystal glass refractor and cast-iron hood, tapped at the top with a $\frac{3}{4}$-in. thread. The glass, which has its central portion painted out with black enamel, is supported by clips held by screws for ease in relamping. In its present mechanical construction the unit accommodates bulbs ranging from 6 to 25 watts, though it can be made to take larger sizes.

Average illumination values range from 0.0002 ft. candles with a 6-watt bulb to 0.0014 ft.-candles with a 25-watt bulb. On the same basis, maximum illumination values range from 0.0004 to 0.0028 ft.-candles. These intensities are based on a 100-ft. spacing between units and a 20-ft. mounting height.

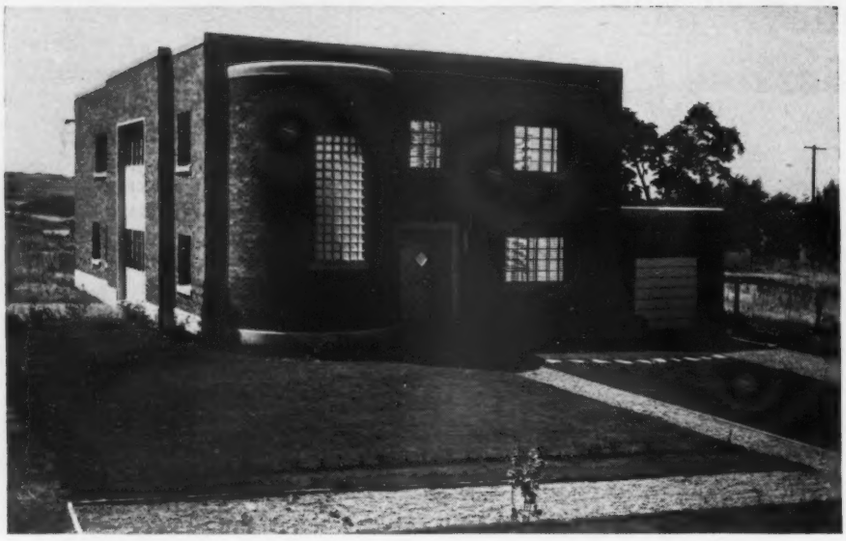
Following requirements of the British air raid precaution specifications, the new unit is a product of Holophane Co., Inc.



BLACKOUT LIGHTING UNIT is suspension-type, consists of one-piece crystal glass refractor and cast-iron fitter



VERTICAL CANDLEPOWER does not exceed 2.0 at all angles below and including 90 deg. Curve taken with 6-watt, S-14 inside-frosted bulb



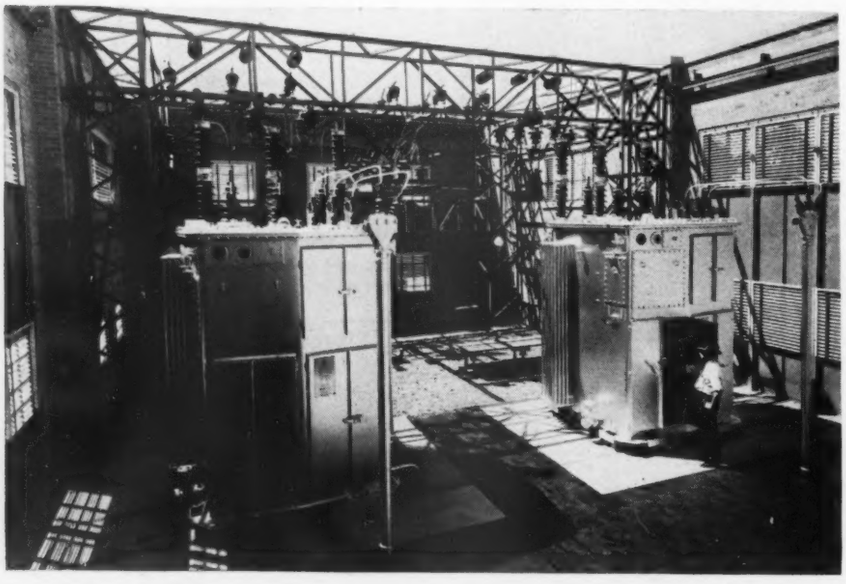
Substation Fits Into Surroundings

Substations

With an architectural design that completely hides the nature of the structure, Parry substation, built by Utah Power & Light Company in Ogden, demonstrates the feasibility of higher-voltage transformation near the physical center of large residential loads. Architectural harmony in a high-class residential area has been achieved by a design that surrounds the equipment with a roofless structure that provides protection, economy and eye appeal.

Inside the walls of what appears to be a typical residence is 44/4-kv. transformation equipment consisting of two 2,000-kva. OISC, three-phase, type CSP transformers, complete with automatic tap-changing-under-load equipment, metering and "inertaire" equipment, secondary breakers automatically reclosing and a tie-in switch for parallel operation. Each is connected to a separate 44-kv. transmission line through a disconnecting arrangement that permits either transformer to carry load from either line or both to operate from the same line. High-side breakers have been eliminated and both line and transformer are cleared by opening the low-tension breaker built into the transformer, in case of transmission trouble. An alarm functions to warn a maintenance man of this operation.

Each transformer carries 2,000 kw. under normal operations, although one will carry the total 4,000-kw. load of the station for a short time.



NOT A RESIDENCE, despite the glass brick, the venetian blinds and the simulated garage door (top of page), but Parry substation, a 4,000-kw., 44/4-kv. residential station built by Utah Power & Light Co. in Ogden, as shown by the interior picture (above)

Industrial Power

Power Supply for Resistance Welders

By C. E. HEITMAN, Jr.*
Electrical Engineer A. O. Smith Corporation, Milwaukee, Wis.

Many of the problems of power supply for resistance welding machines in industrial plants relating to size of power transformer required and the size of feeder line required between power transformer and welder can be solved by a number of relatively simple mathematical relationships. While these relationships involve several approximations, the calculated values obtained are near enough to measured values for practical purposes.

Consider a resistance welding machine — spot, flash or whatever — connected to utility lines. It consists of a welding transformer of a certain ohmic impedance Z_2 and a secondary loop connected to the electrodes and having an ohmic impedance measured or calculated, Z_3. *Equivalent* impedance of the welding machine when viewed from primary side of transformer is:

$$Z = Z_2 + A^2 Z_3$$

where A = ratio of transformation of welding transformer.

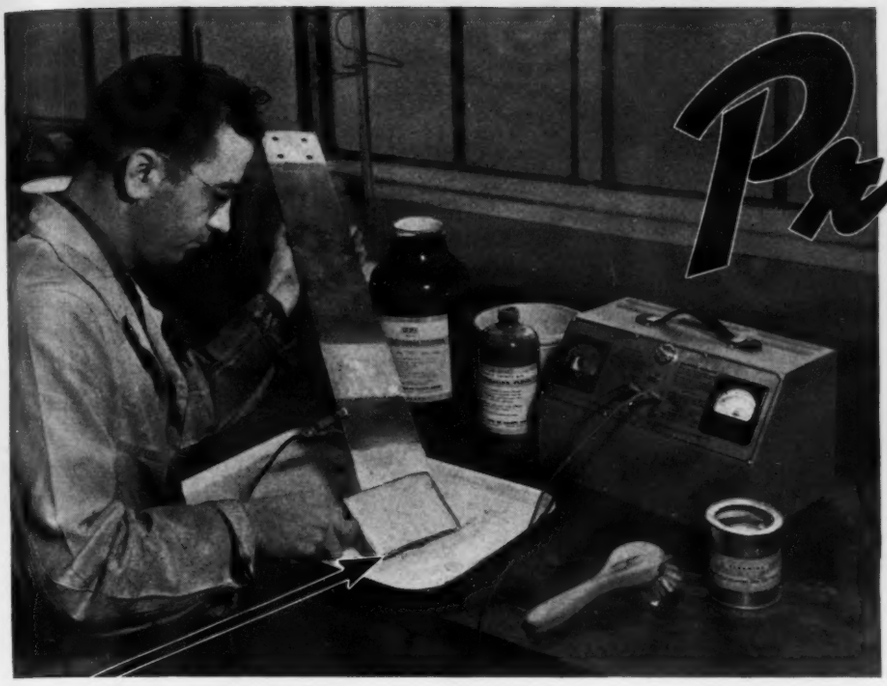
For a welding transformer with tapped primary giving variable secondary voltage, Z_2 is obtained at maximum secondary voltage—minimum turns ratio. Therefore, for any turns ratio *other* than minimum

$$\text{Transformer impedance} = \frac{Z_2 A^2}{A_m^2}$$

This says that transformer impedance is proportional to square of primary turns—not strictly true—but makes little difference in results.

Calling impedance from the primary of the welding machine back to the generating station Z_1, and assur-

* Abstract of a paper recently presented before Great Lakes Power Club.



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IT IS DIFFICULT TO REPLACE

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Prevent Waste:

Industry now, more than ever, requires continuity of power service — replacement of present power equipment is almost impossible. Conservation of copper should receive careful attention. It is now possible, at low cost, to apply pure silver deposits on ***old*** and ***new*** switch gear, buses, breaker contacts, disconnects, cable lugs, instruments, and many other pieces of equipment with the modern

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Pure silver deposits on buses and switch gear reduce loss of power, reduce temperature, improve conductivity, and eliminate corrosion of "hard-to-get" copper equipment.

This original Brush Process applies the finest plating possible. No experience required. Electrodeposits are placed ***only*** where the applicator is applied. This important work can be done safely "on the job" ***without*** service interruptions.

A new improved plating solution — No. 121 — is now being shipped on all orders. It is in convenient paste form and is always ***ready*** for ***instant*** use.

Industrial brush electroplating is low in initial cost and low in production cost. Used by hundreds of Power and Industrial Companies.

Order your installations today.

Fully covered by U. S. Patents.

• New applicators, like shown in photograph (3½" x 5") are heavy, pure silver, bar stock with cloth cover, always ready for use. Recommended for fast deposition of pure silver on bus contact areas. Any size or shape available upon request.

• The new Nylon Monofilament (synthetic bristle) special plating brushes are unaffected by normal plating solutions and last indefinitely.

NEW GROUP PRICE
Complete Installations
All for **$189.50** F. O. B. Chicago

THE GROUP PRICE INCLUDES:

1 IU-7 Power Unit — 110 V., 60 Cy., A.C. — Controlled electroplating type, with full range ammeter and voltmeter. Can be used by two platers simultaneously.
1 Gallon No. 116 Silver Plating Solution (Paste form, ready for use, no liquids)
1 Quart No. 26 Preparation Fluid
1 Pound No. 5 Cleaning Compound
1 No. 28 Cleaning Brush
1 B-14 Pure Silver Applicator for Switch Blades
1 No. 232 Large Type Applicator
1 B-3 Plating Brush—NEW NYLON BRISTLES
1 B-4 Plating Brush—NEW NYLON BRISTLES
1 B-5 Plating Brush—NEW NYLON BRISTLES
1 Each B-3, B-4, and B-5 Pure Silver Anodes for brushes
1 Complete Instruction Chart

Note: One gallon plating solution is sufficient to apply one-quarter thousandth of an inch thickness over approximately 35 square feet. The silver solution plates out 99.9% plus, pure.

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ing that impedances are so nearly in the same phase that they can be added numerically without serious error:

Then current in the primary of the welding transformer

$$I_1 = \frac{E_1}{Z_1 + Z_2 + A^2 Z_3}$$

where E_1 = no load voltage at primary welding machine.
I_1 = current in welding transformer primary.
Z_1 = power system impedance referred to primary of welding transformer.

Secondary current in welding transformer, I_2, is

$$I_2 = AI_1 = \frac{AE_1}{Z_1 + Z_2 + A^2 Z_3}$$

From this relation we can determine with practical accuracy anything we need to know about the welder installation. If it is a new welding machine the value of $Z_2 + A^2 Z_3$ can be obtained from the manufacturer. If it is an existing machine it can be measured. Knowing this, the value of Z_1 necessary to produce a given secondary I_2 or the maximum value of I_2 obtainable from a given value of Z_1 can be calculated.

Differential calculus reveals from the above relationship that maximum secondary current occurs when

$$Z_1 + Z_2 = A^2 Z_3$$

and that the turns ratio at which the value occurs is

$$A = \sqrt{\frac{Z_1 + Z_2}{Z_3}}$$

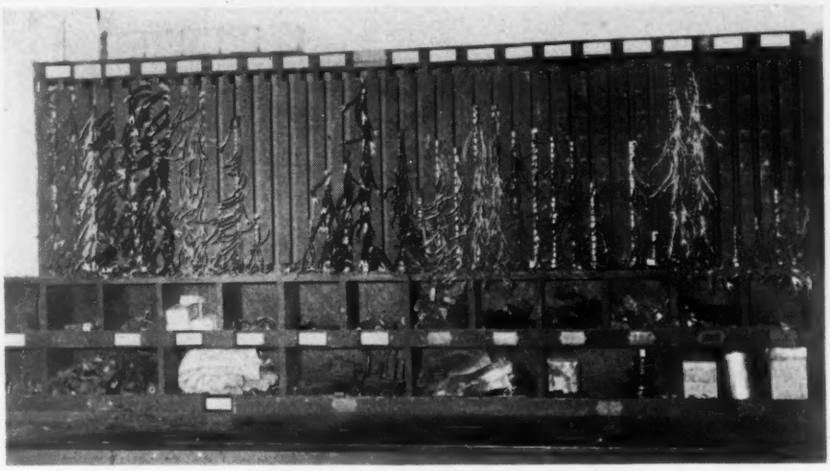
Any value of A less than the above will give lower secondary current. This condition has actually obtained in cases wherein secondary current was increased by reducing open circuit secondary voltage and at the same time primary current was decreased. If a customer is inadvertently operating his welder under this condition he is paying an additional kva. demand charge and imposing a high burden on supply lines.

Since this condition occurs when $Z_1 + Z_2 > A^2 Z_3$ it can be corrected by using a lower secondary voltage and thus increasing A or by decreasing Z_1 or Z_2, but never try to correct by increasing Z_3. Value of Z_2 can be reduced by using a higher welding transformer kva. rating, but in most cases the trouble will be found in a high value of Z_1. This means that the feeder line and power transformer supplying the welding transformer have too high impedance. A larger kva. transformer or a line of lower impedance is the answer.

Neat Rack for Carbon Brushes

Stores

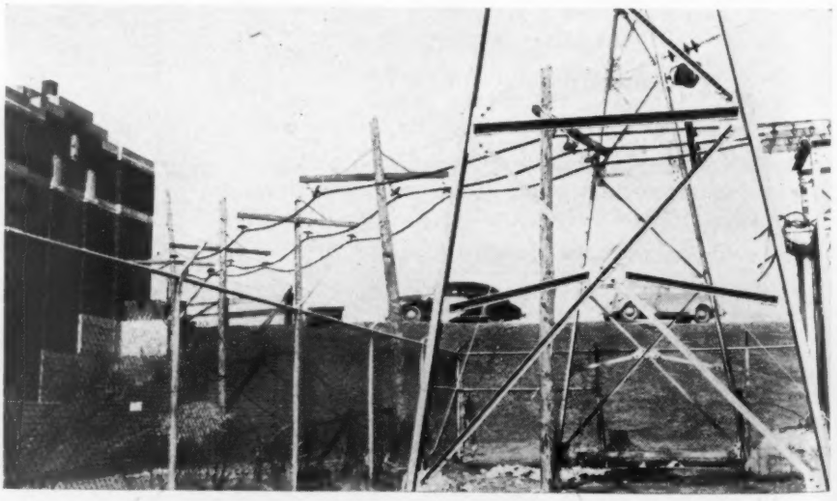
Task of keeping various sizes and types of carbon brushes classified and in good order has been solved at the Omaha plant of the Nebraska Power Company as shown. Brushes of a given size or type are racked in individual vertical compartments with "pigtails" protruding between slat separators. Type and size are given on a tab at the top of each compartment.



Underground Lines

Bundled Conductors Substitute for Cable

When a 2,400-volt main underground feeder cable between the White Rapids hydro plant with its adjacent outdoor substation failed some time ago Wisconsin-Michigan Power Company operators were without a sufficient length of cable of adequate size to replace it. A satisfactory emergency substitute for the burned-out cable (which has consisted of three 750,000-cir.mil cable in parallel per phase) was made up by bundling six No. 4/0 bare copper conductors together for each phase and suspending them from hastily erected poles as shown in the accompanying illustration. Side-light was the ingenious use of tallow candles to check for excessive heating at the point where the emergency cable was attached to substation busbars. When candles placed on the joint failed to melt, it was assumed that the emergency cable would stand the load imposed.



EMERGENCY INSTALLATION—Bundled conductors suspended from hastily erected poles substituted for burned-out cable

Photo Courtesy Eagle Signal Corp.

CONTROLLED Traffic

"SPEED with SAFETY"

If you would like more information about Simplex-ANHYDREX Underground Cables we shall be pleased to send a descriptive booklet upon request.

This unusual traffic intersection was a knotty problem for the traffic engineer who had to control it with traffic signals. Simplex-ANHYDREX Underground Cables were specified and used because it would be difficult and expensive to get at the cables after installation and there had to be a minimum of traffic interruptions. With ANHYDREX the possibilities of corrosion, electrolysis, sheath currents and other troubles that frequently interfere with operation of metallic sheath cables could be ignored. Some of the cables are in conduits and others laid directly in the earth.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

SIMPLEX WIRES CABLES

Blown Generator Coils Show Corona Cutting

Hydro Plant

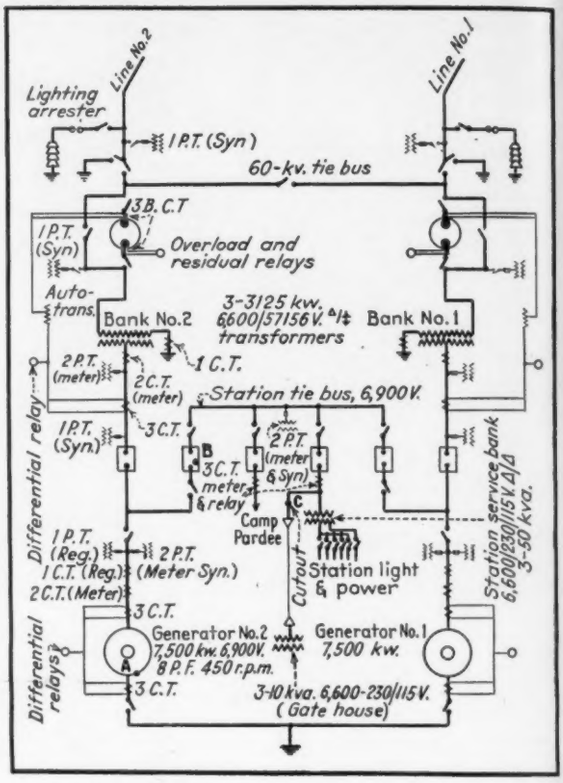
By H. A. Knutsen
Mechanical and Electrical Engineer, East Bay Municipal Utility District, Oakland, Calif.

When a direct lightning stroke on the outgoing 60-kv. transmission lines of the Pardee power house passed arresters and station transformers and went to ground through windings of one generator it brought to light corona damage in generator coils and resulted in a quick maintenance job. This plant is located in the Sierra foothills in a region not considered subject to severe lightning storms. However, arresters were installed on the outgoing 60-kv. lines.

On March 13, 1941, an unsually severe lightning storm centered about the plant and one stroke very close to the plant passed arresters and transformers and went to ground through generator No. 2 ("A" in the diagram). No. 1 generator was not operating at the time. The differential relays functioned and tripped the main circuit and field breakers, caused the governor control for the turbine to operate and tripped the carbon-dioxide fire-extinguishing apparatus. In addition an interphase discharge occurred in circuit breaker No. 4 ("B" in the diagram), causing some slight damage. Also, the oil-filled fuse on the gate house feeder blew in one phase ("C" in the diagram). Direct damage to the generator was the grounding of four coils just below the bottom end of the stator slots. Damage to stator iron was slight.

Generator insulation is Class B (A.I.E.E.) and consists of mica tape covered by varnished cambric and cotton braid. The cambric and cotton in the lower half of the slots, upon removal of the coils, was found to be very brittle. This condition was worst in the quadrant of the stator where the line and neutral connections are brought out. The coils showed evidence of probable corona by small pits noticeable in the outer insulating material.

The pitting was largely confined to the regions where the cotton material was most brittle and was present in the vicinity of both the neutral as well as the line connections.



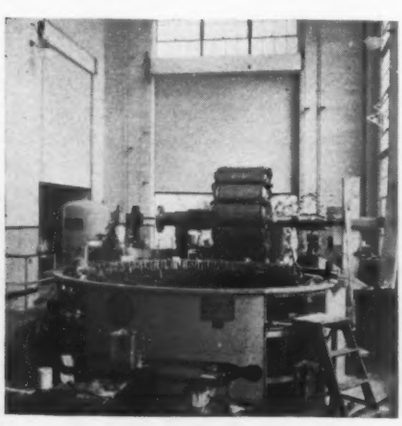
LIGHTNING STROKE on one outgoing line burned out four coils in No. 2 generator at "A," caused an interphase discharge in circuit breaker "B" and blew one phase of the oil fuse at "C"

Because of the inability to determine the extent of the brittle condition with the coils in place, it was deemed advisable to remove all 180 coils and replace them with an entirely new set. A quarter set, or 45 coils, was on hand in the plant, but, because of the evidence of corona action, it was decided to install coils with a layer of ferrous-asbestos tape over the cotton within the slots.

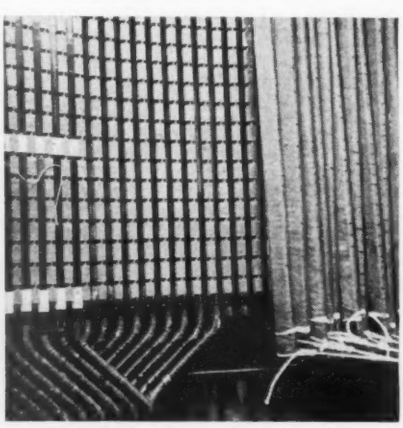
New coils were ordered on March 15 and on April 19 the first shipment arrived. The placing of coils was carried on 24 hours a day and completed, the coils dried out and tested and the generator placed in operation on May 6.

Results of high potential tests on the removed coils may be of interest. A number of the coils, selected at random, were clamped between steel bars held in place by "C"-clamps to simulate slots and voltage was applied between the copper of the coils and these dummy slots. All coils tested withstood 10,500 volts, which is slightly in excess of 2½ times normal voltage to ground (6.9 kv. between phases, 4 kv. to ground). None of those tested to breakdown ruptured below 20,000 volts and a number withstood 29,000 volts for one minute. New coils were tested at 19,800 volts.

It is quite evident that in an emergency most of the removed coils could be used again with a very good margin of safety.



GENERATOR dismantled for repairs



NEW COILS being placed

RATIO ADJUSTER

Moloney Ratio Adjuster Operating Handle Located Above Hot Oil Level

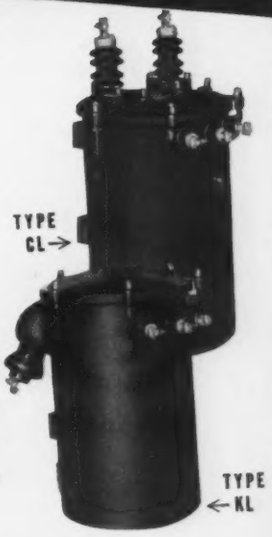
No need to fumble around in hot oil to change terminal board connections or ratio adjusters located below oil level.

Moloney Transformers are all provided with snap-action ratio adjusters with operating handles located above the hot oil level.

There are no links or nuts to accidentally drop into the tank. Ratio adjusters also eliminate the possibility of making wrong connections.

Moloney Ratio Adjusters are sturdily built and require no maintenance. The double-wedge type contacts snap into place with a wiping action. Beryllium copper springs provide permanent high-pressure contact.

These ratio adjusters are provided on all Type KL and Type CL transformers. Type KL is equipped with pocket-type high voltage bushings. Cover-type high voltage bushings are provided on Type CL.



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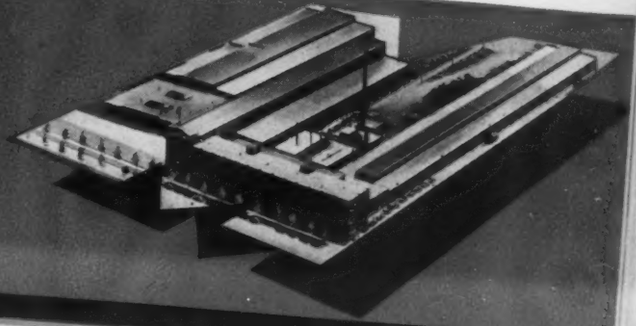


LOAD BUILDING

Infra-Red Drying Cuts Process Costs

Drying of clear lacquer on jetalized sheet steel clock backs and gold and chromium plated clock sashes at the Sessions Clock Company, Forestville, Vt., was formerly done by 100-lb. steam in pipes running through a wooden tunnel. The steam had to be left on continuously each day, with a resulting substantial waste of heat; continual replacement of pipes, repairs to traps and the rebuilding of the wood oven every five years made this method of drying both unsatisfactory and costly. To heat up the former oven for work took 1½ hours, and in its operation so much heat was thrown out into the room that a ventilating fan was required to remove the air. A recently completed infra-red installation designed and built by Charles A. Swanston, plant engineer of the company, has revolutionized the conditions and greatly reduced costs.

The new oven is equipped with 24 R-40 250-watt infra-red lamps (G.E. and Westinghouse) and is but 9 ft. long against 20 ft. for the old steam oven. The width of each was about 18 in. The lamps are mounted 10 in. above the work in standard porcelain sockets connected by slow-burning wire. There are two outside rows of lamps in the center section on a separate circuit which can be switched on and off as required by the shape of the pieces going through. These lamps are set at an angle and are used when pieces having angles are passing them, which insures uniform drying of the corners of hat-shaped work. The clock backs vary from 3 to 12 in. in diameter and are either flat or hat-shaped (⅛ in. to 3 in. high). The clock sashes vary from 3 to 8 in. in diameter.

After spraying, the operator drops the pieces in a chute feeding a galvanized iron link chain belt driven at 10 ft. per minute through a worm gear by a ¼-hp. motor. Finished pieces pass down another chute to a container. The infra-red oven gives instant heat and no ventilating fan is required. Operating cost of the oven has been cut from 48 cents per hour with steam to about 7 cents per hour with electric heat; additional working space has been made available, and lost time due to repairs has been eliminated. Experiments are now in progress in connection with the drying of colored lacquers on bakelite clock cases.

ELECTRIC OVEN runs on 7 cents per hour, against 48 for steam predecessor, which was 20 ft. long. Twenty-four 250-watt infra-red lamps are used in new 9-ft. ovens

•

Hotbeds Heated by Lamps Win Favor

By ROBERT L. ZAHOUR
Connecticut Light & Power Company, Waterbury

Extensive researches by the University of Connecticut and our company covering more than three years of electric heating of hotbeds point toward wider use of this method over longer periods than formerly. The reliability of electrical supply, accuracy of control available, low cost of energy to the farmer and uniformity of heating assured in comparison with the fermentation method are most convincing. The use of cellulose acetate film instead of glass has advantages in this work, provid-

Whether you light square inches of space on business machines or acres of industrial space, General Electric makes the right lamp for the purpose. For the former, the small 6-watt fluorescent lamp is useful. For the latter, the new 3000-watt mercury lamp may be the answer.

G.E. Announces Big New 3000-watt MAZDA Mercury Lamp!

Designed for High Bay Lighting

LENGTH—54⅞ inches overall

LUMENS—Approximately 120,000 initial

PRICE—List price is $45.00

To help industry speed production of war material on a 24-hour basis, General Electric now makes available a new G-E MAZDA Mercury lamp. Eight times more powerful than any previous lamp of its kind, the new G-E MAZDA AH-9 is 54⅞ inches long and is rated at 120,000 lumens.

This new tool is ideally suited for steel mills, foundries, erecting shops, and other large industrial areas where high bay lighting is needed . . . and where swift and accurate seeing can speed up production. Rated at 2000 hours life, it will effect economies in cost of operation, servicing and maintenance, as compared with smaller mercury lamps.

See your General Electric lamp supplier for details.

G-E MAZDA LAMPS

GENERAL ELECTRIC

ECONOMICAL assembly of 25-watt lamps in strips to span hotbed sections

ing a greater heat-insulating value, retaining its elasticity and strength for years, transmitting more of the vital solar rays and costing about the same as glass. In the tests a film 0.005-in. thick was used.

Under the direction of Dr. A. M. Porter and with the co-operation of the U. S. Department of Agriculture, final verification of previous tests has lately been made with vegetable plants placed in standard hotbeds. These have four 3-ft. x 6-ft. sashes each. Glass-covered and film-covered sashes, with soil cables and tungsten lamps, were used. Two beds were provided with high-grade chemically active manure, two were each equipped with two 60-ft. soil-heating cables of 400 watts each with one thermostat control, and two beds with inside-frosted, 25-watt tungsten lamps, eight lamps being provided per sash. That is, there were 200 watts per sash in all electrically heated beds. It was found undesirable in earlier tests to use higher wattage gas-filled lamps on account of the creation of hot spots with non-uniform soil temperatures, spotty germination of seeds and a tendency toward scorching growing plants.

The 25-watt lamps were mounted with inexpensive porcelain sockets on 8.5-in. centers upon the under side of 1-in. x 4-in. x 6-ft. removable wooden strips spanning the beds just below the center of each sash. It was 19.5 in. from the lamp to the soil surface. Efficient reflectors were omitted because the recovery of radiant energy lost through sash transmission was too small to justify them, and these would also have increased the bed surface illumination, causing undue acceleration of plant growth. Thermographs were installed in each bed and watt-hour meter records made. Each bed was watered at the same time and maintenance labor kept at a minimum. The minimum set temperature was 55 F.

Film-covered beds gave equal if not better results than glass in field growth. Lettuce, cauliflower and cabbage heads averaged larger and seven days' earlier maturity with lamp heating. Tomato, pepper and eggplant growth speed was not affected by this method of heating.

Comparative operating costs in the final series of tests were (electricity at 2.5 cents per kw.-hr.): (a) Bulb-heated, film-covered beds, per day per sash, $0.05; (b) same for bulb-heated, glass-covered beds, $0.0575; (c) cable-heated, film-covered beds, $0.06; (d) cable-heated, glass-covered beds, $0.0675. Plants started in the bulb-heated, film-covered beds produced a greater field harvest six days earlier than any of the others, with superior quality and weight.

It is believed that in the face of the urgent need for priority metals for defense preparations, the use of lamp bulbs for heating and film for sash covering is economically desirable in relation to previous methods.

•

Regulation W Cuts Appliance Sales

Effects of Regulation W, governing consumer credit buying, upon purchase of electrical appliances from dealers in the city of Memphis, Tenn., is clearly discernible from the accompanying tabulation taken from Dealer Appliance Sales Reports of Memphis Light, Gas & Water Division for July to October, 1941, inclusive.

Data for the two months immediately preceding and immediately following the inauguration of Regulation W (September 1, 1941), reveals several marked irregularities: (1) A marked upsurge of anticipatory buying during August—the month before the regulation went into effect; (2) a sharp decline in unit sales during September, and (3) a continued but slower decline in unit sales during October.

In all but range, water heater and vacuum cleaner lines, unit sales during August increased 5 to 56 percent over July. During September, however, all lines except water heaters ranged from 38 to 84 percent of July sales, with sales of all appliances down to 43.5 percent of July. In October sales ranged from 27 to 90 percent of July, with all unit appliances sales 47.5 percent of July. Vacuum cleaners alone showed an increase. It is notable that in both September and October refrigerator sales lead the decline.

Unit Sales of Electrical Appliances

	July		August		September		October	
	1941	1940	1941	1940	1941	1940	1941	1940
Indirect lamps	442	292	692	343	287	447	355	633
Other portable lamps	794	436	1,061	468	566	855	553	863
Refrigerators	1,383	913	1,625	736	525	688	381	399
Ranges	42	24	42	25	29	33	26	16
Water heater	25	9	12	25	34	19	22	11
Ironers	64	34	96	38	27	45	44	31
Vacuum cleaners	115	36	92	55	55	114	133	186
Radios	1,149	973	1,441	933	963	1,143	1,050	1,356
Table cookery	482	.....	505	.....	237	.....	339	.....
Total electrical appliances	8,456	5,903	8,159	6,773	3,681	4,441	4,015	3,718

ANNOUNCING—

A Great New Fluorescent Lamp Starter

THE HYGRADE PREMIUM MIRASTAT

Automatically breaks lamp circuit when lamp wears out—stops "flashing"—saves current—protects ballast—lasts longer!

THIS remarkable new lamp starter spells great news for all users of any kind of fluorescent lighting equipment!

For the new Hygrade Premium Mirastat Starter is the only standard starter on the market that breaks the lamp circuit when the lamp reaches the end of its useful life, reduces the flow of current through starter and ballast to a negligible point, *and at the same time stops the flow of current through the lamp electrodes!*

It prevents "flashing" of dead lamps – makes group replacements practical – saves current – prolongs ballast, lamp and starter life!

Think what that means in terms of *better production* in plants – where "flashing" lamps may cause annoyance and delay. Think what it means in terms of greater *efficiency* and *economy* everywhere!

Slightly higher in price, the Premium Mirastat supplements Hygrade's regular line of Mirastats – which have the same mechanism, excepting the dead lamp cut-out feature, and are still offered without price premium.

In all Hygrade starters, an exclusive timing device insures positive starting and re-starting – even at low temperatures or high temperatures.

The Premium Mirastat is completely interchangeable with all standard types of starters – it can be used for replacement as well as in *any* new fluorescent installations.

Anyone who's been bothered with starter troubles will find it the answer to a prayer! Write today for complete information to Dept. MEW 2, Hygrade Sylvania Corp., Salem, Mass.

At this time of snow and ice
Starting must be most precise!

All Mirastat Starters are approved by Underwriters' Laboratories, Inc.

"Everything that's Finest in Fluorescent"

HYGRADE SYLVANIA CORPORATION

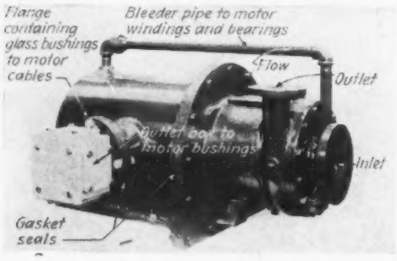
SALEM, MASS.

Manufacturers of Hygrade Incandescent Lamps, Fluorescent Lamps and Fixtures, and Sylvania Radio Tubes

NEW EQUIPMENT

Motor-Pump Unit

To circulate power-transformer cooling and insulating liquid between the tank and cooler, an open type motor directly



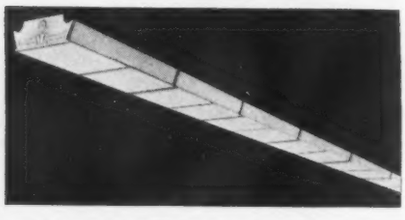
Immersed motor-pump unit; capacities from 50 to 500 g.p.m. at 20 to 60 ft. head. **General Electric Co.**, Schenectady, N. Y.

connected to a pump is designed to be immersed in the pipe lines connecting the transformer and cooler. The liquid flows through the motor rotor windings and bearings of both pump and motor, cooling the motor-pump unit as well as the transformer. Unit is built to operate in any position.

•

Fluorescent Luminaire

New shielded lighting fixture, developed to meet standards of Utilities Research Commission, has brightness that does not exceed 0.9 candlepower per sq.in., it is claimed. Side panels are ribbed ceramic-coated glass with transmission factor of approximately 35 percent; bottom panels are prismatic ribbed glass, transmission of not less than 85 percent. Fixtures for ceiling and continuous row mounting (illustrated) "slide" into metal track attached to ceiling; also available for pendent mounting.



Model "No 2032" U.R.C. "Research" luminaire; utilizes four 40-watt, 48-in. fluorescent lamps. **Mitchell Manufacturing Co.**, 2525 Clybourn Ave., Chicago, Ill.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

•

Motor Control

Adjustable speed drive from a.c. power lines is obtainable by a motor control unit with an electronic rectifier and a d.c.

"Series 400" motor control; sizes ¼ to 200 hp., d.c., any voltage. **Electron Equipment Corp.**, Palm Springs, Calif.

motor, from zero to basic speed or above. Constant d.c. voltage is delivered to shunt field to maintain torque, while armature voltage can be changed to any value without wave form distortion, it is claimed.

•

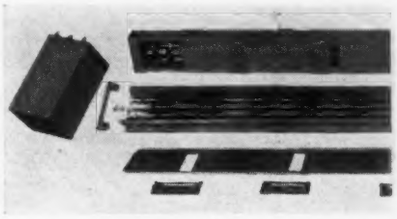
Pressure Switch

"Class 9213A3" pressure switch; up to 200 lb. pressure, 15 to 40 lb. differential, 110 to 550 volts, 2 hp. single-phase, 3 hp. polyphase, ½ hp. d.c. **Square D Company**, 6060 Rivard St., Detroit, Mich.

Inclosed two-pole pressure switch for intermediate size air compressor motors has porcelain terminal block. Terminals are in an upright position for wiring. Pressure setting table is attached to slip-on cover. Release valve may be manually unloaded without opening the switch contacts.

BUS-BAR

For industrial secondary power distribution systems, a new bus-bar consists of copper buses, Prestite separators, and a



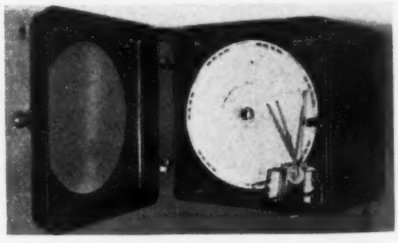
Bus-bar; plug-in sections supplied in 10-ft. line units. Capacity 250 through 1,500 amp.; higher capacities also available. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

dust-tight metal inclosure. Outlet service is staggered every 12 in. along a run. Outlet receptacle covers slide along duct to expose plug-in connections. Duct may be hung edgewise or flatwise.

•

Telemeter

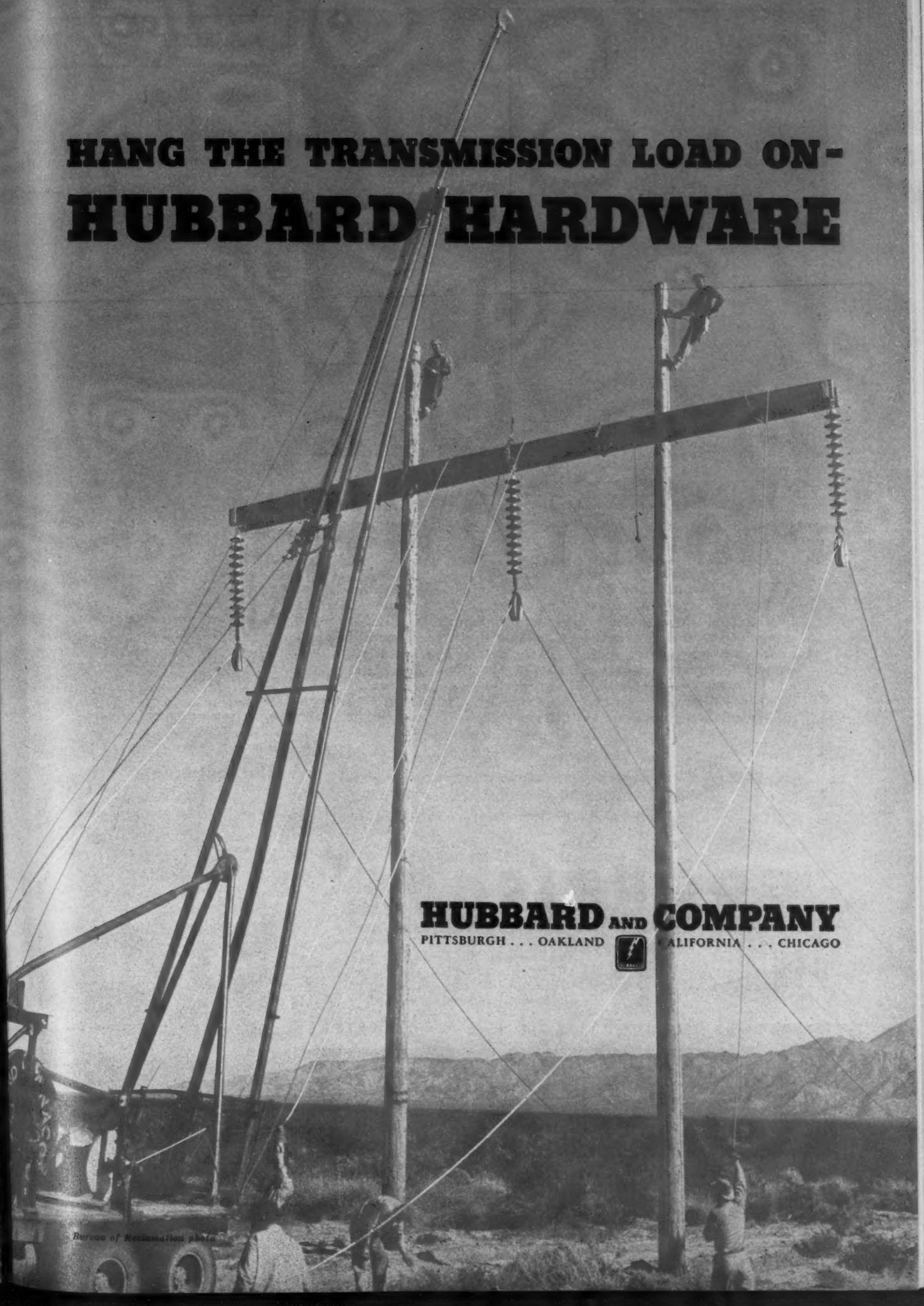
Telemeter receiver has operating mechanism simplified by use of magnetic clutch, thereby eliminating a gear train, a cam switch and three relays. Two arms are provided for high and low alarms. It can be used in conjunction with company's supervisory control, or a number of telemeters can be operated over the same remote channel consisting of two wires or equivalent.



Type "TM-5" telemeter receiver. **Control Corporation**, 600 Stinson Blvd., Minneapolis, Minn.

Air Raid, Blackout and Protective Concealment Materials and Devices are listed on page 104

HANG THE TRANSMISSION LOAD ON-
HUBBARD HARDWARE



HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

Bureau of Reclamation photo

FORESIGHT demands FLOODLIGHT!

WITH America at war, there can be no excuse for negligence these days . . . no excuse for trying to make hindsight answer for foresight. Every plant producing goods for war or even civilian needs is vitally important to the national welfare. Responsibility for guarding against sabotage is the problem of each plant individually.

Floodlighting of grounds is the first step in industrial protection. Do it *now!* Do it properly! See your nearest Goodrich distributor or write us.

We invite those responsible for providing safeguards against sabotage in industrial plants to write for this timely and helpful circular. Ask for folder No. 101.

GOODRICH
INDUSTRIAL LIGHTING

GOODRICH COMPLIANCE WITH RLM

The Goodrich line includes a wide variety of incandescent and fluorescent fixtures for every industrial requirement. Literature on request.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

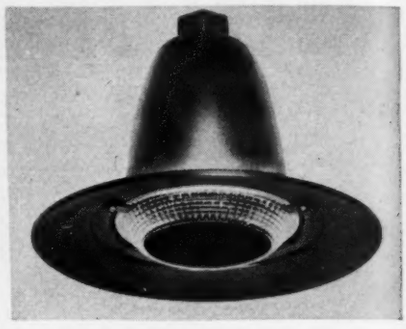
GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4626 BELLE PLAINE AVENUE, CHICAGO, ILL.

"BLACKOUT" EQUIPMENT

Blackout Light

New blackout lighting unit is of the suspension type. It consists of a one-piece crystal glass refractor and cast-iron fitter, arranged to give an illumination range of 0.0002 to 0.0004 foot-candles on the horizontal plane when used with a six-watt S-14 bulb, with 100-ft. spacing between units and a 20-ft. mounting height. Maximum candle-power does not exceed 2.0 at all angles below and including 90 deg. Unit is said to follow requirements of British Air Raid Precaution Specification.



"B-4952" Blackout Light; present design accommodates 6- to 25-watt bulbs. **Holophane Co., Inc.**, 342 Madison Ave., New York, N. Y.

•

Paint

Camouflage paint; nine standard colors. **Vita-Var Corporation**, Newark, N. J.

A non-penetrating type of paint has non-reflecting flat finish and can be used as one-coat finish on all types of surfaces, it is claimed. Colors are said to have been adopted for camouflage purpose by the Army Engineers.

•

Blackout Bulb

For indoor visibility during blackouts, new bulb is designed to provide a soft beam of blue light. It has a silver reflector lining inside said to hide filament glare and to project light downward. Light leaks are prevented, it is claimed, by a black silicate coating that covers the bulb up to the extreme lighting end which is a deep blue.

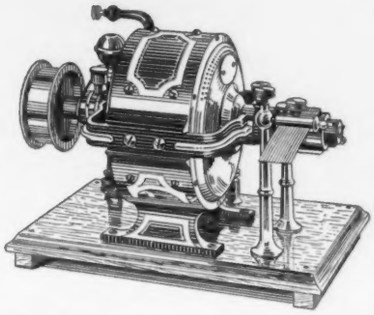
Blackout bulb; 25 watts. **Wabash Appliance Corp.**, 33 Carroll St., Brooklyn, N. Y.

TWO LEADERS

HANSON-VANWINKLE-MUNNING CO. · MATAWAN, NEW JERSEY, U.S.A. · SINCE 1820

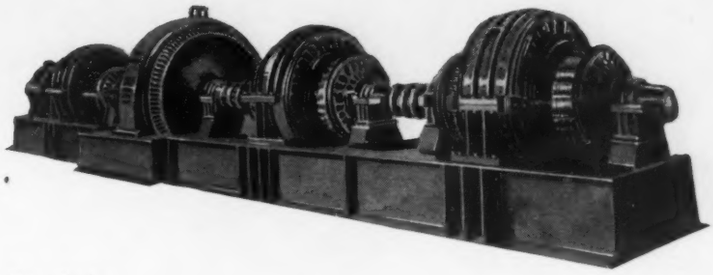
STANDARD OF THE WORLD
IRVINGTON INSULATION
TRADE MARK
REG. U. S. PAT. OFF.

GET TOGETHER ON GENERATOR INSULATION



1876

The first recognized practical electro-plating generator. Built in 1876 by Hanson-VanWinkle-Munning Co. Now on display in Henry Ford Museum.



1942

Hanson-VanWinkle-Munning's modern long-life, high-efficiency Motor Generator Set.

Hanson-VanWinkle-Munning Company, leaders in the manufacture of electro-plating generators for 66 years, specify IRVINGTON and HARVEL INSULATING VARNISHES for perfect insulation in their generator armatures and fields.

Development of these Varnishes is the result of Irvington's 36 years' experience in meeting demands for insulating varnishes of the highest quality for dipping, brushing, spraying, vacuum and pressure applications. There's an IRVINGTON or HARVEL INSULATING VARNISH for every electrical need.

IRVINGTON VARNISHES are of the oxidizing type, containing drying oils; HARVEL 512-C and 612-C BAKING VARNISHES are phenol-aldehyde synthetic resins, made from cashew nut shell liquid, solidifying throughout by heat induced chemical polymerization.

The IRVINGTON line consists of Clear and Black Baking Varnishes; Clear and Black Air Drying Varnishes; Black Insulating Paint; Black Air Drying, Baking and Flashing Core Plate Varnishes; Clear and Black Oilproof Finishing Varnishes; Clear Sticking Varnish; Red Oilproof Enamels, Gray and Black Machinery Enamels. In the HARVEL line are Baking and Air Drying Varnishes and Red Finishing Enamel.

For complete data send for the new 34-page HARVEL and IRVINGTON INSULATION VARNISH CATALOG. Write Dept. 46

Irvington VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U. S. A.

STANDARD OF THE WORLD
IRVINGTON INSULATION
TRADE MARK
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PLANTS AT IRVINGTON, N. J. and HAMILTON, ONT., CAN.
Representatives in 20 Principal Cities

RUBBER COVERED POWER CABLES • BUILDING WIRE • BARE WIRE • MAGNET WIRE • SERVICE ENTRANCE CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE

CRESCENT

ARMORED CABLE • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • VARNISHED CAMBRIC

Genuine **A.B.C.**

Armored Bushed Cable

SAFEST *Factory Assembled* **WIRING SYSTEM**

CONDUCTORS —Clean stripping insulation and flame retarding covering, printed as shown.

BUSHING—easy to insert as paper unwraps from *under both ends* of armor to make room for the bushing.

STEEL ARMOR — low resistance, electro-galvanized for maximum uniformity and longest life.

TESTED—Thoroughly tested at several points during manufacture and receiving a final test of 2000 volts between conductors and armor.

CRESCENT has unexcelled facilities for the COMPLETE manufacture of Armored Bushed Cable in all its steps. When you buy CRESCENT A.B.C. ARMORED BUSHED CABLE you buy the best. Do not be satisfied with any substitute.

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE

Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER • AGING INSULATION

Hand Lamp

Portable battery-operated lamp has an aluminum reflector with a matte finish. Bulb has two filaments independently operated by the same switch as a precaution against filament failure. Either a wire stand or shoulder strap may be used with the lamp.

Model "C" Wheat hand lamp; weight 67 oz. **Koehler Manufacturing, Inc.**, Marlboro, Mass.

•

Paint

"Infray" paint; green, tan, black and four intermediate shades. **The Arco Company**, Cleveland, Ohio

New type of paint has been developed for protective concealment and to meet tentative Navy specifications for infra-red reflecting paints for use on fuel storage tanks, buildings and certain types of equipment where dark colors as well as heat reflecting qualities are required.

•

Siren

New siren for an air raid alarm has a rising sound pitch or howl that reaches its maximum tone in from three to five seconds. It is said to be audible for miles and is adapted for signaling because of a sharp sound cut-off.

"Standard" siren; operates on air or steam at 50 to 250 lb. pressure at 425 deg. F. total temperature. **Foster Engineering Co.**, 109 Monroe St., Newark, N. J.

•

Paint

"Lumi-Tone" phosphorescent paint. **General Luminescent Corp.**, 732 Federal St., Chicago, Ill.

A new paint which must be activated by natural or artificial light is said to be suitable for coating objects, such as markers, stair edges, door frames, etc., also wearing apparel for individuals assigned to blackout duties, so that they can be seen in total darkness.

MANUFACTURING-MARKETS

Westinghouse Orders Rise 46 Percent

Westinghouse Electric & Manufacturing Co. has announced that net sales billed in 1941 amounted to $369,094,124, compared with $239,431,447 in 1940, an increase of 54 percent. Orders received during the year amounted to $582,808,634, compared with $400,477,724 in 1940, an increase of 46 percent. This amount does not include $30,757,103 worth of orders placed with the company for production at ordnance plants being operated by Westinghouse for the Navy.

Unfilled orders at December 31, 1941, totaled $419,550,654, compared with $223,685,737 at the end of 1940, an increase of 88 percent. Net income during the year was $23,117,510, compared with $18,985,428 in 1940, an increase of 22 percent. This represents $7.21 per share of capital stock.

In the report, A. W. Robertson, chairman, disclosed that the company had increased its deliveries more than 50 percent during 1941. A major part of the equipment billed by the company was for the country's war effort. More than 19,000 employees had joined the company in 1941 to help handle the record production load. Employment is now at an all-time high of 77,877, compared with 58,503 at the beginning of 1941.

•

Fluorescent Price Cuts Shown in G. E. Report

As of January 1, 1942, fluorescent lamps were 57 percent lower in price than in 1938, when they were first introduced, according to the lamp department of General Electric Co. In 1941 these lamps showed a 23 percent price reduction over the previous year.

For all lamps, miniature as well as large, prices as of January 1, 1942, were 75 percent below 1921 figures. Large lamps showed an even greater decrease—almost 77 percent—for the corresponding period, and were 51 percent below 1929 prices.

•

Facilities Enlarged by Ferranti Electric

With its business running two to three times normal volume, Ferranti Electric, Inc., is devoting 100 percent of its output to national defense.

The company's engineering staff and factory personnel have been augmented and the plant is now three times its former size in preparation for increased orders this year.

•

New Copper Plant Opens

C. Donald Dallas, president of Revere Copper and Brass, Inc., has announced that the new $10,000,000 defense plant at Chicago, which is being operated for the account of the War Department, is in partial operation, five months ahead of schedule. Ground for the plant was broken last summer.

Production Requirements Group Formed by NEMA

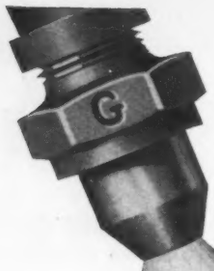
In order to consider problems relating to the Government Production Requirements Plan, from the electrical manufacturing industry point of view, the board of governors of the National Electrical Manufacturers Association has authorized the setting up of a committee to be devoted specifically to this phase of priorities.

President G. C. Thomas, Jr., has appointed the following to serve on the new committee:

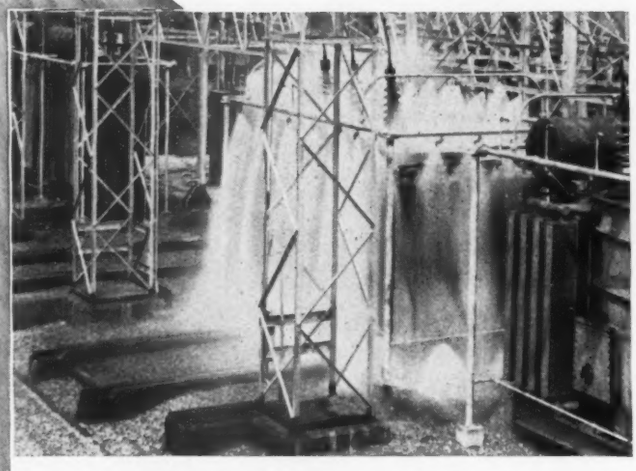
Clarence L. Collens, chairman, Reliance Electric & Engineering Co.; L. R. Brown, General Electric Co.; M. C. Carroll, Chase-Shawmut Co.; B. A. Fleming, Edwin L. Wiegand Co.; H. B. Crouse, Jr., Crouse-Hinds Co.; R. W. Davis, Allis-Chalmers Manufacturing Co.; A. C. Farmer, Westinghouse Electric & Manufacturing Co.; F. R. Fishback, Electric Controller & Manufacturing Co.; L. H. McClure, Colt's Patent Fire Arms Manufacturing Co.; C. L. Nicholson, II, Pass & Seymour, Inc.; E. L. Robinson, Crescent Insulated Wire & Cable Co.; W. M. Scott, Jr., I-T-E Circuit Breaker Co., and R. W. Staud, Benjamin Electric Manufacturing Co.

The committee will study the prob-

BURNDY SALES CONFERENCE—New-product developments for utility and industrial application, latest manufacturing developments and sales promotion for 1942 were topics at the recent eastern and midwestern sales conference of Burndy Engineering Co.



Simpler, Surer ANTI OIL-FIRE Equipment



APPLIES WATER IN NON-CONDUCTING SPRAY!

The unique Mulsifyre Oil-Fire Protection System works on the positive principle of emulsifying the surface of blazing oil with water spray to make it non-flammable. It is successfully employed today by leading utilities the country over.

Grinnell Mulsifyre Systems are fixed equipment, operated either manually or automatically. High-pressure water admitted to the system creates high-velocity spray so fine that it is electrically safe... so fast it stops fire in 2 to 5 seconds!

WRITE for authoritative Data Book on Mulsifyre Systems by Underwriters' Laboratories. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of the U. S. and Canada.

GRINNELL
MULSIFYRE
Fire Protection Systems

lems of operation under the Production Requirements Plan and will make recommendations as to the best method of handling such problems.

•

Refrigerator Curtailment Cuts Employment by 30%

Electric appliance, rubber and automobiles are releasing the greatest number of workers as a result of curtailed production, according to the *Survey of Current Business.* Hardest hit is the refrigerator and refrigerating apparatus industry, in which employment dropped from 54,500 in the peak month of June, 1941 to 37,900 in November—latest month for which data is available—a drop of slightly over 30 percent in the six-month period. In the washing machines, ironers, wringers and driers classification, in which output was less sharply cut, employment fell some 14 percent in the same period, going from 10,400 in June to 8,800 in November.

Further decreases in employment are likely, the *Survey* indicates, pointing out that output in these lines is expected to be limited very drastically presently. However, "conversion in part to wartime output is possible."

•

Break Ground For Six Electric Furnaces

Ground was broken in Chicago recently for six electric furnaces at the Chicago plant of the Republic Steel Corp. The six furnaces will have a capacity of about 500,000 tons annually. Early reports estimated the cost at $40,320,000.

The new furnaces will exceed in size any electric furnace operation now in the Chicago district, including two new furnaces recently placed in operation.

•

Lamp Life Increased

Hygrade Sylvania Corp. has announced that the rated life of the 100-watt fluorescent lamp has been increased from 2,500 hours to 3,000 hours, effective February 2.

New York Metal Prices

	Feb. 3, '42 Cents per Pound	Jan. 28, '42 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	6.50	6.50
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	8.64	8.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	15.00	15.00

* Delivery Connecticut Valley.

Field Reports on Business

Much heavy electrical equipment is being required for the expanding war program. Reports indicate that electrical appliances will feel the brunt of the curtailment resulting from the shift to an all-out war basis. Retail buying in anticipation of shortages continues heavy.

NEW YORK

The vast new program for speeding conversion of the nation's industries into one great war factory is now under way. Output for military use continues to move ahead as an ever-growing number of industries restrict their production for civilian consumption.

Engineering construction last week totaled $221,694,000, climbing sharply to the highest weekly total reported since August 7, 1941. This represents an increase of 74 percent above the preceding week and 124 percent above the corresponding week last year, according to *Engineering News-Record*. Public construction, also the highest since last August, is up 69 percent compared with the preceding week, and 232 percent above a year ago. Private awards are 172 percent higher than in the preceding week, but 54 percent lower than in the 1941 week. The week's volume brought 1942 construction to $628,780,000, an increase of 7½ percent over the five-week period last year.

As a result of indications that production of both large and small appliances will be shut off entirely soon, appliance dealers reported this week that their chief difficulty will come during the peak selling season for refrigerators during April and May. January sales of refrigerators have been very slow and there has been little inroad on present stocks. Dealers believe they can take care of a limited demand, but they expect low stocks by the summer.

Buying in anticipation of shortages continued heavy at both retail and wholesale last week. Sharp percentage gains again featured retail trade in the metropolitan area, despite unfavorable weather on several days.

PACIFIC COAST

New developments in the ever-increasing industrial west include a joint installation at Spokane, Wash., of the aluminum plants previously planned for Fairview, Ore., and Los Angeles, each costing $20,000,000 with a 30,000-ton annual capacity. Magnesium and other allied products account for a new $11,000,000 unit at Sunnyvale, a $3,500,000 dolomite plant in San Benito County, a sillimanite plant at Bishop, all in California, and a $3,000,000 calcium plant with a 1-A priority near Luning, Nev., for Basic Magnesium, Inc. In the Bay area floating drydocks will be built at Rio Vista, marine turbines at Sunnyvale, $9,000,000 of sailing tugs near Napa and bearings and a food supply plant at Redwood City.

Recent orders include $78,629 for G.E. carrier-current equipment for Bonneville system; $635,182 for three penstock gates for Coulee plant; $20,000 of transformers and circuit breakers for irrigation at Yakima, Wash., Indian reservation; $21,000 control mechanism for Colorado-Big Thompson project; $110,000 for welding rods and accessories for G.E. equipment; six 100-kw. generators and exciters costing $20,000, and nine crane motors and controls costing $30,000 for Mare Island. Line material awards cover $64,859 for No. 4 Bonneville crossing at Bradford; 10,000 insulators for the same system; $104,888 Phelps-Dodge copper cable for 230-kv. steel tower line No. 3 between Bonneville and Coulee, and $43,682 cable for Central Valley project. The Friant Dam of this project is nearly concreted, but the requisite machinery will not be installed until after present emergency.

Wholesalers report good sales for January, largely on basis of deferred shipments carried over from December, but with an encouraging influx of business, such as for fluorescent lighting installations, which is only indirectly defense.

NEW ENGLAND

Negotiations for heavy electrical machinery required for naval and merchant ships contracted by New England shipyards are demanding urgent attention. Construction of power company generating units aggregating in the neighborhood of 160,000 kw. is being pushed by manufacturers for installation during 1942. Small motor sales are confined to group orders ranging in lots up to 50 or more and are being received at regular intervals. In the city of Boston small motor installations in connection with factory changes and additions during the past week showed that industrial activity continues at an increasing pace.

More than $50,000 in supplies and labor has been spent lately in installing air-raid alarm systems and telephone lines in eastern Massachusetts. Waterbury Clock Co., Waterbury, Conn., is to start construction immediately of a "blackout" type building artificially lighted and air conditioned and provided with boiler plant and cafeteria.

Hartford, Conn., finished the largest appliance year on record. Electric range sales in 1941 increased 40 percent, refrigerators 57 percent and water heaters 57.

CHICAGO

Additional pressure is being applied to swiftly move business into the production of armaments. The new War Production Board is working feverishly to confine the use of all vital materials to war purposes. It appears likely that ranges, refrigerators, washing machines, small electric appliances, radios, vacuum cleaners, lamps and similar items will feel the brunt of further curtailment.

Retail trade eased up somewhat last week and department stores recorded a 13 percent decline in sales from the preceding week, although holding a 33 percent gain over a year ago. Industrial activity kept at record levels as orders for war equipment moved steadily upward.

Sangamo Electric Co. reports a backlog of government orders amounting to $1,500,000 as of January 19. The company states that February should show less than 2 percent of all shipments on a non-priority basis. Federal Electric Co. has been flooded with orders for air raid sirens and is now producing 350 per day. The rate will be increased to 600 per day if sufficient materials can be secured.

Inland Steel Co. will install an electrolytic tin coating plant at its Indiana Harbor Works. Republic Drill & Tool Co. will install 20 circuits, 116 lights, two 75-kw. furnaces and 24 motors totaling 110 hp.

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HIBAY
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Reduces Costly Errors
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READY NOW
Contains less critical metals . . . Built to Holophane standards of scientific illumination. Conserves materials, man-power and effort . . . One of 4 types, each with a different distribution.
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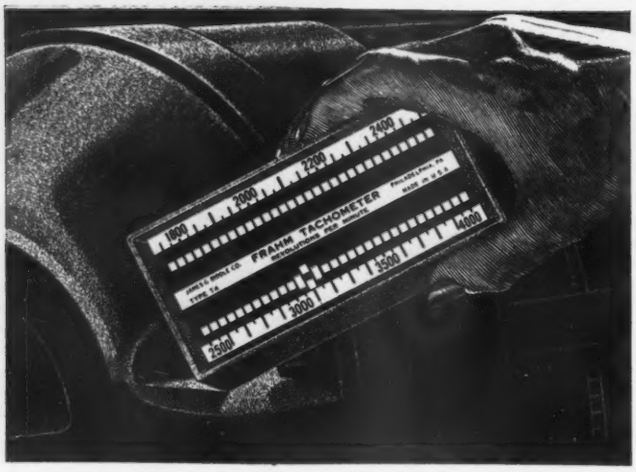

Measure Speed—Simply by Touch

Consider the advantages of a Portable Hand Tachometer that does not even "see" the rotating shaft, that has no wearing parts or pointer, that requires no belts, gears or electrical connections and that cannot lose its calibration through lack of oil or over-speeding.

Write for Bulletin 1590-W

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Pull Poles this safer, faster way!

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Poles are not "chewed up" as when pikes are used. Cable or chain can be used to pull poles with the No. 329 Pole Jack shown. Lifts 15-tons a full 23 inches. Jacks load up or down. No. 318 has same capacity, but has trip for dropping load. No. 325 is combination pole puller, straightener, guy line tightener and cable puller.

Make the most of available manpower with Simplex Jacks for utilities and electrical contractors—send for Bulletin U42.

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Copperweld Steel Opens New Chicago Office

Copperweld Steel Co. announces a change in its sales representation in the Chicago district, which comprises the states of Kentucky, Indiana, Michigan, Wisconsin, Illinois, Missouri, Iowa, Minnesota, North Dakota, South Dakota, Nebraska and Kansas. Heretofore Copperweld sales activities in these states have been handled by Steel Sales Corp.'s Copperweld Department in charge of W. W. Ege.

Effective February 1, Steel Sales will no longer represent Copperweld and Copperweld Steel Co. announced the opening on February 2 of its own Chicago district office at 122 South Michigan Avenue. The Chicago district will be under the supervision of Mr. Ege, who becomes western sales manager. Territorial representatives in the Chicago district will be: E. G. Elg, assistant western sales manager, Chicago; J. P. Gould, Chicago; H. V. Rathbun, Kansas City, Mo.; A. B. Leach, St. Louis, Mo.; R. C. Raasch, Des Moines, Iowa, and J. J. Healy, Minneapolis, Minn.

•

Conservation of Steel Aided by Standard Oil

To aid the conservation of steel for the American war program Standard Oil Co. of Indiana has appealed to customers who receive lubricating oils and greases in steel barrels to return them as soon as they are empty so that all available barrels may be kept in circulation.

Standard will inclose the appeal with statements or other mail to customers or have drivers distribute to them. On steel barrels themselves a red, white and blue label will be applied reading: "Do your part—We will do ours. Return drums as soon as empty. Keep 'em rolling for defense."

•

Serve War Requirements

Airtemp's commercial refrigeration facilities have been adapted to the national victory program, Malcolm T. Bard, commercial refrigeration manager of the Airtemp Division, Chrysler Corp., has announced. "While the Airtemp commercial condensing units are new to the refrigeration trade," Mr. Bard explained, "they are the outgrowth of a long-range program of developing radial-type refrigerating mechanisms for the requirements of the war effort program and applying them also to essential civilian services. . ."

Given Awards on Parker Dam Transmission Lines

Two additional power lines will be constructed to transmit Parker Dam electrical energy into Arizona and California, Secretary of the Interior Harold L. Ickes has announced.

Fritz Ziebarth of Long Beach, Calif., received the $143,417 contract, covering the construction of a 115-kv. wood-pole transmission line approximately 124 miles long from a switching station at Phoenix, Ariz., to the substation at Tucson, Ariz., and a 161-kv. wood-pole transmission line, approximately 50 miles long, from the switching station at the Gila pumping plant to the substation at the Drop No. 4 power plant on the All-American Canal.

In addition the contract also includes the stringing of two overhead ground wires on the existing 161-kv. wood-pole transmission line extending 117 miles from the Parker power plant to the switching station at the Gila pumping plant.

•

Air Conditioning Council Announces 1942 Plans

Announcement has been made by Walter P. Davis, executive secretary of the Air Conditioning Council of Western New York, that the council will conduct an educational program during 1942 designed to bring to plant engineers, especially in defense industries, information on the operation and maintenance of control instruments in air conditioning. A booklet will be prepared by the council on this subject. Mr. Davis said the council also is offering its services to the Buffalo Defense Council in the matter of educating people in the handling of air conditioning, heating and ventilating equipment during blackouts and other war emergencies.

Walter E. Voisinet, president of Air Conditioning Accessories, was elected president of the council. Other officers for the coming year are: Vice-president, Sherman W. Strouse, Trane Co.; treasurer, Harry C. Shafer, Iroquois Gas Corp. Mr. Davis, Buffalo Niagara Electric Corp., was reappointed executive secretary for the sixth term.

•

Westinghouse Awards

Announcement has been made that C. W. Pomeroy, secretary of the Westinghouse Electric & Manufacturing Co. and Victor S. Beam, assistant to the vice-president in charge of the legal department, have received the Westinghouse Order of Merit Medal.

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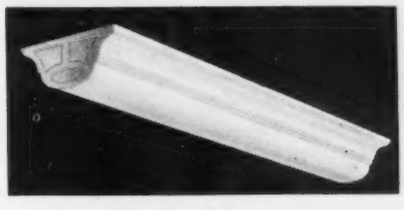

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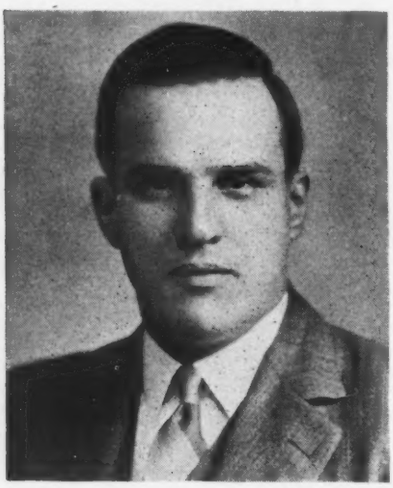
NEWS ABOUT PEOPLE

Central Maine Power Co. Promotes W. F. Wyman

William F. Wyman, since 1934 assistant to the vice-president and general manager of Central Maine Power



Co., has been made general superintendent. He joined the company in 1923 immediately after being graduated from Harvard College, and was for a time engaged in construction at the Messalonskee hydro-electric station in Oakland. Later he worked with the wiring crew. He became district superintendent of operation in the southeastern section, with offices at Boothbay Harbor, and supervised a number of line construction jobs, including the laying of the Islesboro cable.

In 1927 Mr. Wyman was made division engineer with headquarters in Augusta, and in 1928 was placed in charge of rates and schedules. In 1930 he was appointed division manager for the central southern area.

•

► PHILIP A. FLEGER, general attorney for the Philadelphia Co. and subsidiary companies of Pittsburgh, Pa., has been elected senior vice-president of the company. Mr. Fleger joined the company in 1926 and served as an attorney in the law department, and assistant general attorney until 1939, when he was made general attorney for the companies. He was born in Chicago, Ill., and educated at the University of Illinois and the University of West Virginia.

•

Boston Edison Promotes Corney and Haines

Chester A. Corney, superintendent of the engineering department, and Thomas H. Haines, superintendent of the transmission and distribution department, Boston Edison Co., have been appointed assistant vice-presidents, reporting to Robert E. Dillon, vice-president in charge of production, engineering, transmission and distribution.

Mr. Corney has been associated with

C. A. Corney

the company for the past 20 years, serving as assistant superintendent from 1927 to 1937, when he was named superintendent. He was formerly associated for a number of years with the Stone & Webster Engineering Corp., Boston. Mr.

T. H. Haines

Haines' service with Boston Edison began in 1913, two years after his graduation from the Massachusetts Institute of Technology. He will continue as head of the transmission and distribution department in his new position, having been head of that branch of the company's service since 1925. Both are widely known in the power industry.

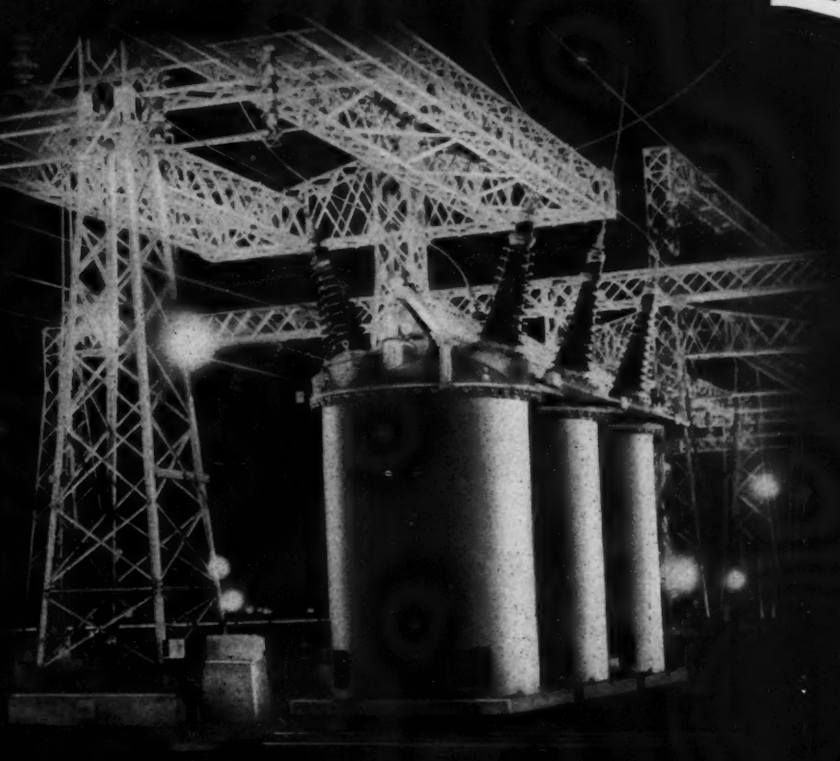
•

I-T-E Circuit Breaker Elects New Officers

W. M. Scott, Jr., has been elected president of the I-T-E Circuit Breaker Co., Philadelphia, Pa., to succeed his father, the late William M. Scott. R. J. Wensley has been appointed general manager of the company.

•

► E. W. KELLS, secretary of the Brooklyn Edison Co., has been elected assistant vice-president and assistant treasurer. He will continue as secretary. S. H. ALLEN, who has been assistant treasurer since 1930, was elected treasurer and assistant secretary. E. F.



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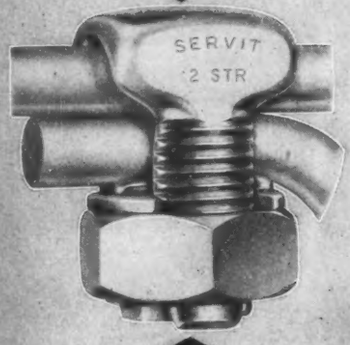

WILL SPEED UP YOUR HOOK-UP

BURNDY 107 EASTERN BLVD. NEW YORK CITY

McGee, who has been office assistant in the treasurer's office since 1934, was elected assistant treasurer.

•

J. B. Fisken Relinquishes Duties in Spokane

John B. Fisken, safety engineer for the Washington Water Power Co. and an employee of the company since its founding in 1889, has retired from active service. A native of Scotland, Mr. Fisken was graduated with honors from the College of Arts and Science, Glasgow, and at the age of 26 migrated to Victoria, B. C., and worked for the Victoria Electric Illuminating Company.

He moved to Spokane, Wash., in 1887 and entered the employ of the

Spokane Falls Electric Light & Power Co., predecessor of the Washington Water Power Co. He served as company light and power superintendent from 1889 until 1918, when he became chief engineer. Two years later he was named consulting engineer and has served as safety engineer since February, 1939.

While working for the Spokane Falls Electric Light & Power Co., Mr. Fisken designed and supervised the building of three power stations and later had charge of the electrical installation for the Washington Water Power Co.'s Monroe Street power station in Spokane, which is still in operation. He is a past-president of the Northwest Electric Light and Power Association and a fellow of the American Institute of Electrical Engineers.

•

▶ John M. Wicht, manager of the home laundry equipment section, General Electric Co., was elected president of the American Washer and Ironer Manufacturers' Association, at the annual meeting held recently in Chi-

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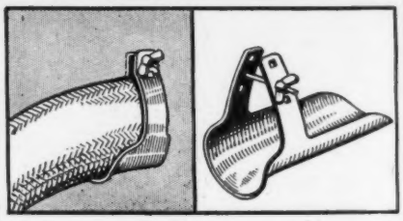

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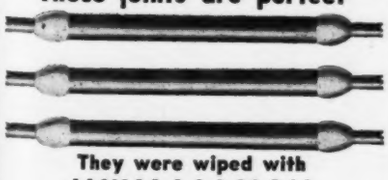

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cago. He replaces W. Neal Gallagher, who completed four terms. Mr. Wicht has been prominent in the affairs of the association.

▶ ROBERT M. KEENEY, industrial manager of the Connecticut Light & Power Co., Waterbury, has been appointed assistant chief of the nickel branch of the materials division of the War Production Board, Washington, D. C. Mr. Keeney is widely known in the metallurgical and utility fields.

▶ COL. WILLIAM KELLY, president of the Buffalo, Niagara & Eastern Power Corp., was made on honorary member of the American Society of Civil Engineers at the recent annual meeting in New York.

▶ E. L. MORIER has been appointed commercial vice-president in charge of sales of the eastern district of the Seyler Manufacturing Co., with offices in New York. For a number of years Mr. Morier has been connected with the pole line industry in the East. Early in his career he became identified with the Naugle Pole & Tie Co. as vice-president, with headquarters in New York. In 1919 he severed his association with the Naugle organization to join the Joslyn Co. in New York in the capacity of vice-president and general manager, the position he retained until his new assignment with the Seyler Manufacturing Co.

▶ HERMAN L. WALLAU, who recently retired as electrical engineer for the Cleveland Electric Illuminating Co., after 40 years of service, is now serving as principal electrical engineer at the Aircraft Engine Research Laboratory, Cleveland. During his affiliation with the Cleveland utility Mr. Wallau was electrical designer of many of its large power plants, including the Lake Shore, Avon and Ashtabula units. A native of New York and a graduate of the Brooklyn Polytechnic Institute, Mr. Wallau was connected with the Brooklyn Rapid Transit Co., Goodson Graphotype Co., Electrical Launch Co. and the Westinghouse Electric & Manufacturing Co. before identifying himself with the Cleveland Electric Illuminating Co. in 1901. He is a fellow of the American Institute of Electrical Engineers and was chairman of the electrical equipment committee from July 1939 to July 1941.

▶ A. W. CONOVER, vice-president and general manager of the Central Ohio Light & Power Co., Findlay, Ohio, has been elected president and chairman of the board of the North Shore Gas Co. of Chicago, effective February 1. Mr. Conover has had considerable experience in public utility management in both electric and gas utilities. He was

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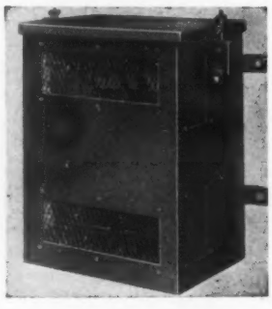

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vice-president and general manager of the Oklahoma Utilities Co., Bristow, from 1930 to 1935, when he was made vice-president and general manager of Colorado Central Power Co., Golden, serving in that capacity until 1939. At that time he transferred his interests to Findlay, Ohio. In 1939 Mr. Conover was awarded the B. C. Forbes Award, and he was also given the Rocky Mountain Electrical Association Award for 1939.

▶ H. D. KELSEY, engineer of the General Electric air conditioning and commercial refrigeration department, Bloomfield, N. J., has been called for the duration of the emergency to take duties in the supercharger engineering department. F. T. GROTHOUSE has been appointed engineer in charge of the department's Winter Street plant in Fort Wayne, Ind., and D. W. McLenegan engineer in charge of the Bloomfield works. Mr. Kelsey's duties take him first to the G. E. Lynn River Works plant and later to the new G. E. supercharger plant in Fort Wayne. Mr. Grothouse joined General Electric in 1921 at Fort Wayne. Mr. McLenegan became associated with the organization in Schenectady in 1922.

▶ J. CALVIN HALL, vice-president of the Indiana Service Corp., Fort Wayne, has been given the distinguished service award made annually by the Fort Wayne Junior Chamber of Commerce to the man not over 35 years of age who is judged to have given the most distinguished service to the community during the year.

OBITUARY

Bion J. Arnold

Bion J. Arnold, consulting engineer, and prominently identified with railroad electrification and the electric traction field, for a number of years, died on January 29 at his home in Chicago, at the age of 80. In the course of his career he was called in as consultant on traction problems by the cities of Pittsburgh, Providence, Los Angeles, San Francisco, Toronto and Cincinnati and he was retained to appraise properties for many of the large electric light and power companies in various parts of the country. His plan for electrifying Grand Central Terminal New York, was carried out while he was a member of New York's Electric Traction Commission. He worked on the project for five years. He was chairman of the board of supervising engineers for Chicago's traction lines for 35 years, from 1907 to the present time.

Colonel Arnold was born in Casnovia, Mich., in 1861, was graduated from

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the Hillsdale College in 1884 and did post-graduate work at Cornell University and the University of Nebraska. He was the recipient of many awards for his engineering accomplishments. He served as president of the American Institute of Electrical Engineers 1903-04, and in 1937 was elected an honorary member as "one who has rendered acknowledged eminent services to electrical or its allied services." He was also a past-president of the Western Society of Engineers and a member of many other engineering societies.

•

▶ GEORGE R. DURGAN, secretary of the Indiana Public Service Commission, died recently. Mr. Durgan was Mayor of Lafayette, Ind., for 20 years and was a former representative in Congress. He was named secretary of the commission several months ago. Mr. Durgan was 70 years old.

▶ COL. HAROLD C. FISKE, retired Army officer and formerly chairman of the Chattanooga (Tenn.) Electric Power Board, died on January 8 at Manhassett, N. Y., following a heart attack. Col. Fiske was a graduate of West Point.

▶ LLOYD T. MCAFEE, for a number of years connected with the Public Works Commission of San Francisco, died in that city on January 1, at the age of 60. Mr. McAfee was manager and chief engineer of the Hetch Hetchy water supply, power and utilities engineering bureau and was head of the commission's electric power bureau. He directed San Francisco's building program on Treasure Island in preparation for the Golden Gate International Exposition and also had charge of construction at the San Francisco airport.

▶ CHARLES G. R. KEMP, electrical engineer in charge of the design of power plants, substations and transmission lines for the Atlantic Service Utility Corp., Reading, Pa., died on November 3. Mr. Kemp engaged in electrical construction work in the United States and Brazil and was identified for a number of years with the Westinghouse Electric & Manufacturing Co. before he joined W. S. Barstow & Co., at Reading, Pa., in 1922 as electrical engineer in charge of all electrical designs for power houses, substations and switching stations. In 1933 he became electrical engineer in charge of the design of power plants, substations and transmission lines for the E. M. Gilbert Engineering Corp. at Reading. From 1938 to 1941 he was engaged in similar work with the Utility Management Corp,. also at Reading, and early in 1941 he joined the Atlantic Utility Service Corp.

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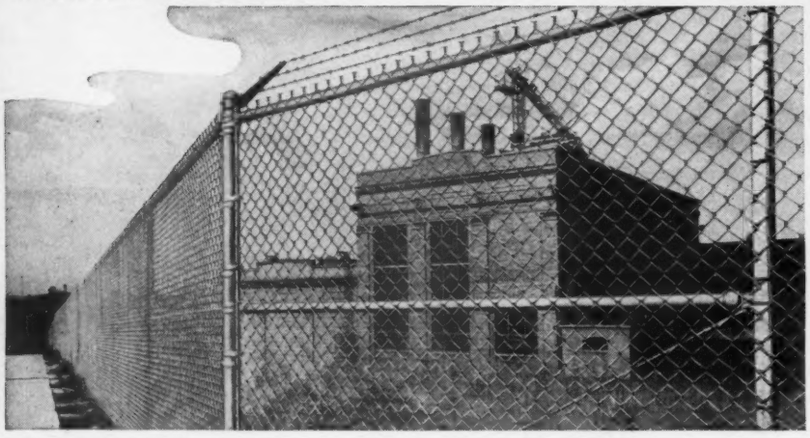

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LETTERS TO THE EDITOR

Comment on Mercury Cycle

To the Editor of ELECTRICAL WORLD:

Those here who are familiar with steam power production have the impression that the editorial "Mercury Cycle at Maturity" (ELECTRICAL WORLD, December 27, 1941) goes too far in implying the probability of general use of the mercury cycle.

Since the plants operating on the mercury cycle were designed there have been substantial increases in the over-all efficiencies of high-pressure steam units we believe approaching those to be expected of the mercury cycle. It is not clear to us that the inherent advantage of the latter, even assuming satisfactory solutions of operating difficulties, are sufficient to balance the capital cost and complications which also are inherent with it. Changes in the relative importance of capital cost, operating cost and fuel cost readily may be the deciding factors rather than differences in cycle efficiency.

Recent results with the mercury cycle seem to reflect some gratifying solutions of operating difficulties rather than a final answer to the question of relative desirability of the two cycles, mercury and high-pressure steam.

H. C. DICKINSON, Chief
Heat and Power Division,
National Bureau of Standards,
Washington, D. C.

•

Father of the Standard Plug

To the Editor of ELECTRICAL WORLD:

In your issue of January 10 is announced the death of Robert S. Hale, and I cannot let the moment pass without asking you to draw attention to another outstanding project which Mr. Hale carried through for the National Electric Light Association, *viz.*, the standardizing of attachment plugs and convenience receptacles.

As the representative of one of the interested manufacturers, I attended all of the meetings of Mr. Hale's committee and can testify that he handled the delicate negotiations with a maximum of intelligence, persistency and tact, and a minimum of heart-burning on the part of the manufacturers, some of whom felt that they were being asked to surrender what they considered very valuable equities.

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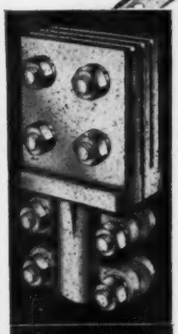

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granted, but those of us who recall the chaos which prevailed prior to 1915 know that the standard plug has been an important contributor in load building with every utility in the country, not alone residential load, but to a considerable extent from industrial customers also.

FRANK V. BURTON,
Philadelphia, Pa.

•

Deliveries or Withdrawals?

To the Editor of ELECTRICAL WORLD:

Your "Priorities" supplement, in the January 10 issue of the ELECTRICAL WORLD, is going to be very useful. I should like to call attention, however, to an error in connection with your interpretation of the P-46 order.

Speaking of the restrictive provisions of this order you state that "no utility shall, during any calendar quarterly period, accept deliveries of materials for use for repair and maintenance or as operating supplies in excess of 25 percent of the dollar volume of *deliveries* of materials of the same class during all 1940, or at the company's option, during the corresponding 1940 quarter."

Actually, I believe you will find that the OPM order ties deliveries of such materials into 1940 *withdrawals* rather than 1940 deliveries. Quoting from the order, "no producer shall, during any calendar quarterly period accept deliveries . . . which shall exceed 25 percent of the aggregate dollar volume of the *withdrawals* of items of materials of the same class . . . etc."

Inasmuch as many utilities were doing considerable advance buying during the rising price period of 1940, this distinction as between a withdrawal and a delivery base may be of some importance.

ALAN PASSEN,
Buffalo Niagara Electric Corp.
Buffalo, New York.

[The writer of the letter is correct. This should have been "deliveries" instead of "withdrawals." We are glad to have it brought to our attention.—EDITORS.]

•

Home Front Morale in England

To the Editor of ELECTRICAL WORLD:

I believe that the statements made in the interview with Miss Caroline Haslett which appeared in the January 3 issue of ELECTRICAL WORLD should receive much wider publicity among central

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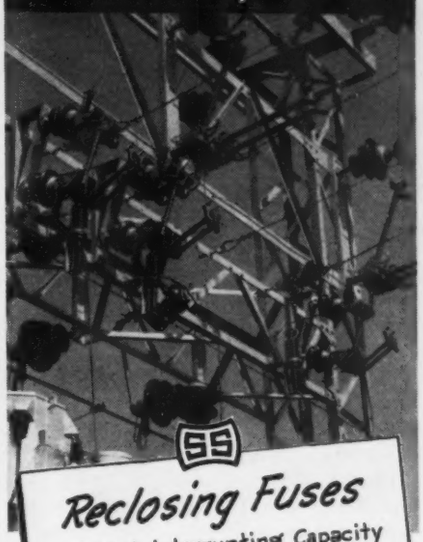

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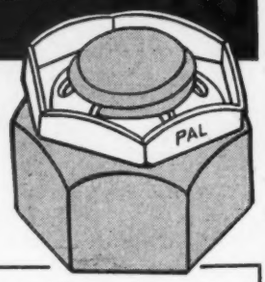

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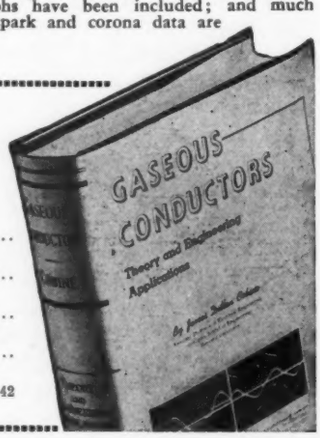

station people. The conclusions reached by Miss Haslett are certainly a strong argument for continuance of certain types of utility activities and they certainly are particularly authoritative in view of her experience in England.

H. G. CLUM, Manager
Lighting Sales Department,
Jersey Central Power & Light Co.,
Asbury Park, N. J.

•

Municipal Plants

CLEWISTON, FLA.—By a vote of three to one, citizens have decided to purchase the privately owned Glades Power & Light Co. and Glades Water Co., at a cost of $125,000 and to spend another $50,000 on their extension and improvement.

EDINBURG, TEX.—Proposal to issue $925,000 municipal revenue bonds for construction of an electric light and power plant, water supply and distribution system, sponsored by Mayor A. A. Aldrich and city council, was defeated at recent election by a vote of 360 to 128. City is now being supplied with electricity by Central Power & Light Co.

•

Starts Power Delivery

Bonneville Power Administration's new substation at Cosmopolis has recently been energized and now is delivering power to the Grays Harbor Public Utility District No. 1, S. E. Schultz, Bonneville's chief engineer, has announced. Coincident with the start of service at Cosmopolis, engineers made transformer changes at Bonneville's Raymond substation, increasing the voltage on the line north to Cosmopolis and a line south to the government's Tide Flats substation from 22,000 volts to 66,000 volts.

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GENERAL ELECTRIC

Sales Opportunities

CHICAGO, ILL.—Commonwealth Edison Co. has approved plans for two-story addition, about 72x202 ft., to Northwest generating station, 3438–42 North California Avenue, and will begin superstructure at once. A building permit has been issued. It will be equipped for increased capacity. Cost about $180,000, exclusive of equipment. Holabird & Root, 333 North Michigan Avenue, are architects.

SLATER, IOWA—City Council, Philip Rood, city clerk, receives bids until February 24 for switchboard and power wiring, station transformers and accessories, instruments, etc., for new municipal power plant. Also for construction of station building, about 34x34 ft. Ralph W. Gearhart, 349 Twenty-first Street, S.E., Cedar Rapids, Iowa, is consulting engineer.

VANCOUVER, WASH.—Kaiser Shipbuilding Corp., Vancouver, recently formed as a subsidiary of Oregon Shipbuilding Corp., St. Johns, Portland, Ore., plans installation of motors and controls, transformers and accessories, duct lines, electric cranes, electric hoists, portable electric tools, conveyors and other equipment in new shipbuilding plant on Vancouver waterfront. It will consist of a series of 12 shipbuilding berths, outfitting docks, one and multistory shops and other structures, including power substation and boiler house. Cost estimated close to $12,000,000, with financing in that amount to be provided by government.

LOS ANGELES, CALIF.—Bureau of Power and Light, 207 South Broadway, plans call for bids in March for superstructure for Unit No. 1 of new Harbor steam-electric generating station, South Lagoon Avenue, Wilmington, for which foundations are now under way. It will be reinforced-concrete, with cost estimated close to $300,000, exclusive of equipment.

SPOONER, WIS.—Spooner Municipal Utilities will take bids in near future for new hydroelectric generating station, supplementing present municipal power plant of same type. Cost about $250,000. L. A. DeGuere, Wisconsin Rapids, Wis., is consulting engineer.

FRESNO, CALIF.—Southern California Edison Co., Los Angeles, Calif., has preliminary plans for new hydroelectric generating station on San Joaquin River in Fresno and Madera counties, where site is being selected. Plant will have estimated ultimate capacity of 118,000-hp., and is estimated to cost approximately $5,500,000, including transmission line for connection with present high-tension system. Application has been made for permission to divert required water from river, totaling over 70,000 acre-feet per annum, for plant.

MIDDLEBURY, CONN.—Waterbury Clock Co., Inc., 31 Cherry Avenue, Waterbury, Conn., manufacturer of clocks and clock mechanisms, plans installation of motors and controls, transformers and accessories, duct lines, fluorescent lighting system, air-conditioning system, regulators, conveyors and other equipment in new instrument assembling plant at Middlebury, near Waterbury, about 300x400 ft. A boiler house will be built. Cost about $700,000. Bids will be asked soon on general erection contract. Leo F. Caproni, 1221 Chapel Street, New Haven, Conn., is architect and engineer.

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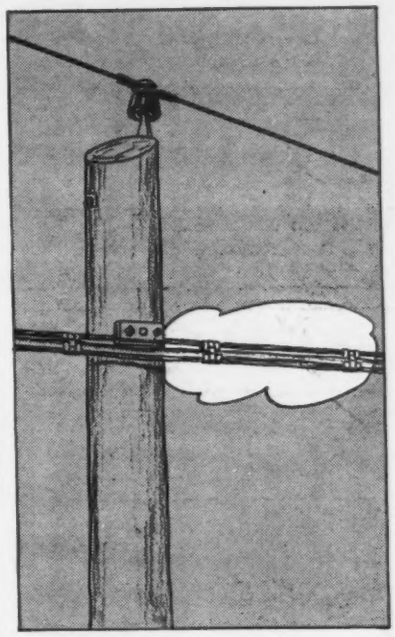

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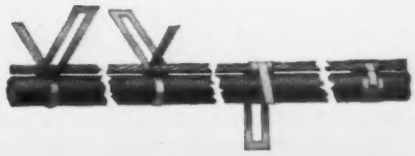

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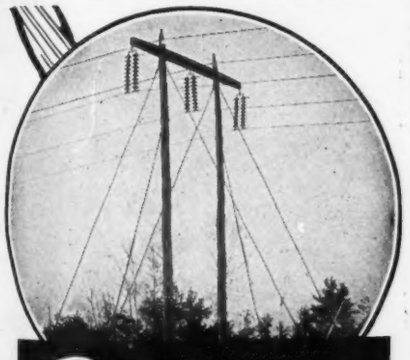

Crapo
GALVANIZED STEEL
STRAND

STRENGTH, ruggedness and durability are combined with definite economy in *Crapo* Galvanized Steel Strand. Low first cost, low maintenance expense are matters of record wherever this time-tested product is in use. Available in all standard grades and sizes from representative jobbers throughout the country. Or, write—

INDIANA STEEL & WIRE CO.
MUNCIE, : : INDIANA

BEDFORD, IND.—Public Service Co. of Indiana, Inc., Indianapolis, plans new power substation in vicinity of Bedford for increased power for industrial and other service in that area. Cost reported over $125,000, including equipment and high-tension line connections.

ROSWELL, N. M.—United States Engineer Office, Albuquerque, N. M., receives bids (no closing date stated) for installation of an electrical distribution system and street-lighting system at Roswell airfield, including 6,600 ft. of single-phase, primary feeder lines, 10,000 ft. of No. 6 or larger secondary and service lines; 200 treated southern yellow pine poles, 25 to 40 ft. high; 2,000 ft. of double-circuit, three-phase, four-wire, 4-kv. primary feeder lines, and 2,600 ft. single-circuit feeder lines; 1,200 ft. of three-phase, four-wire, 4-kv. underground feeder lines in fiber conduits, with junction boxes and accessories. Also, 50 distribution type transformers, two constant current transformers and auxiliary equipment; indoor-type switching station, with four electrically-operated and one manually-operated oil circuit breakers with accessory apparatus; disconnecting switches, framework, etc.; 70 concrete street-lighting standards, and 50 bracket-mounted lights on distribution poles, concrete standards to be served with parkway cable lines.

OCCOQUAN, VA.—Occoquan Co., Occoquan, care of Charles B. Hawley Engineering Corp., Munsey Building, Washington, D. C., consulting engineer, has surveys and plans under way for new hydroelectric generating station on Occoquan Run River, vicinity of Tidewater, Va., where site has been selected. Project will include a power dam, about 125 ft. high, forming a water reservoir over a total of about 2,600 acres of land; and hydroelectric power plant, with initial capacity soon to be determined. Also transmission lines and other operating facilities. Entire project is estimated to cost close to $5,000,000. Application has been made for federal permission. Engineer noted is in charge, with George H. Knutson, 61 Broadway, New York, N. Y., consulting engineer.

MERRIMACK, WIS.—Wisconsin Power & Light Co., Madison, Wis., plans new power substation in vicinity of Merrimack, for power supply for a large industrial plant in that district, and will extend transmission lines for connection with new station. Work is scheduled to begin soon.

TEXAS CITY, TEX.—Firestone Tire & Rubber Co., Akron, Ohio, plans installation of motors and controls, transformers and accessories, regulators, fluorescent lighting system, duct lines, conveyors and other equipment in new plant in vicinity of Texas City for production of synthetic rubber. It will consist of several one and multi-story processing and production units, with auxiliary structures for storage, distribution, etc. A power substation will be built. Site is being acquired and work will be placed under way soon. Entire project is reported to cost over $2,500,000, with machinery and equipment.

WATERLOO, WIS.—Water and Light Commission, Chester Palmer, secretary, receives bids until February 19 for expansion and improvements in municipal power plant, including installation of new turbine-generator unit and accessories, boiler, steam and water piping systems and auxiliary equipment. Commercial Testing & Engineering Co., 307 North Michigan Avenue, Chicago, Ill., is consulting engineer.

Figure Eight Double Tube Sleeve

Seamless Oval Type Sleeve

Split Tinned Sleeve for Underground Cables

This Precision Made Line of

Sherman Splicing Sleeves

Meets Every Requirement Of the Light and Power Industry - -

Sherman Splicing Sleeves make the finest of joints—strong, corrosion-free, and of highest conductivity. All sleeves made to accepted standards, stamped for indentification, and carefully packed. Utilities the country over are today standardizing on Sherman Splicing Sleeves because they provide maximum dependability at strictly competitive prices.

Write for Sherman Catalog illustrating the complete Sherman line of electric specialties and giving full specifications. Let us send you samples of material in which you are interested, for your own examination and test.

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

Wisconsin Budget Based on War Needs

Wisconsin Public Service announces that its 1942 construction budget will total $4,088,287 and consist largely of projects having a direct relationship to the war-time needs and restrictions of the territory being served.

Of the four-million-dollar total, $2,299,000 covers the cost to complete construction already in progress, principally the 30,000-kw. addition to the Bayside steam-electric plant at Green Bay, work on which is progressing as rapidly as materials and equipment can be secured. Altered schedules call for completion by the fall of 1942.

Major items in the $1,789,287 of new construction are two interconnections with the power system of neighbor utilities, with the objective of strengthening the electric power supply in the local areas concerned and throughout the territory served by the cooperating utilities.

One of these construction items calls for an expenditure of $82,700 for an interconnection with the lines of the Wisconsin Electric Power Co. between New Holstein and Elkhart Lake. It will supply Calumet and sections of Manitowoc and Sheboygan counties with an emergency power source and should improve service during emergency periods of bad storms, accidents and other unforeseen difficulties.

A major interconnection between the system of Wisconsin Power & Light Co. at Fond du Lac and Wisconsin Public Service Corp. at Oshkosh will supply added power capacity to all customers of both utilities, as well as furnish an extra emergency power source to Oshkosh-Fond du Lac area users. This project is expected to cost Wisconsin Public Service $280,000.

Both of these projects are slated for work in the spring of 1942, if intercompany negotiations continue without interruption and the necessary materials are not delayed. It is expected that both will have OPM approval because of their significance in national defense plans.

Because of the difficulty in getting wire, transformers, meters, and other supplies experienced in 1941, fewer rural and urban extensions will be possible during 1942 than during previous years. All essential improvements have been planned for, however, with electric distribution additions in all divisions estimated at $691,664. Although large in total, the individual items are small and are intended to increase service capacity where needed and to eliminate situations liable to cause outages.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : BUSINESS : "OPPORTUNITIES" : EQUIPMENT : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00

Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.

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Individual Spaces with border rules for prominent display of advertisements.

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An advertising inch is measured ⅞ vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

CIVIL SERVICE OPPORTUNITY

Subject to Examination
Civil Service,
Jefferson County, Birmingham, Alabama
EMPLOYMENT WITH
Bessemer Electric Service
Transmission & Distribution System
Bessemer, Alabama

SALARY: Beginning $212.50 per month, maximum $237.50 per month. One appointment for each System.

QUALIFICATIONS: Not less than 28 years of age; hold a degree in electrical engineering from an accredited school of engineering; not less than five years of experience in designing, installing and operating an electrical distribution system (either public utility or industrial) of which not less than three years shall have been in responsible charge of such distribution system; administrative ability; ability to supervise and direct subordinates and to acquire and maintain their confidence; ability to act in emergencies; good judgment; ability to maintain good public relations; integrity; good physical condition and good moral character.

DUTIES: Under general supervision to be responsible for the operation, maintenance and extension of the electric distribution system.

If interested write Mr. Joseph M. Hagerty, Manager, Bessemer Electric Service, 1812 3rd Ave. North, Bessemer, Ala., giving complete experience, record, education and personal characteristics.

POSITION VACANT

ENGINEER wanted by Ohio manufacturer to develop and design airport lighting fixtures, beacon and flood lights. Must be thoroughly experienced lighting engineer on this or similar class of work. Good opportunity. P-27, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 32 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R.W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN, Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

MANAGER (Draft exempt). Twenty years successful experience both large and small organizations. Electric, gas, water, heating, ice, merchandise. Steam, hydro, oil engine plants. Public relations, load building, construction, present day problems, etc. Accustomed to full charge of operations, or as district manager. Many years present connection. Present conditions make change desirable soon. References. Let me handle your toughest situation. PW-26, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

GRADUATE MECHANICAL - ELECTRICAL ENGINEER with 25 years experience in responsible positions with public utility and large manufacturing companies. Have been in charge of planning and designing complete projects including purchase and installation of equipment, letting contracts, supervising construction and maintaining plants in operation. PW-28, Electrical World, 68 Post St., San Francisco, Cal.

POSITIONS WANTED

AVAILABLE — ELECTRICAL ENGINEER—construction and operation electric power, industrial plants. PW-29, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER State Registered, 12 years utility experience—8 in executive capacity — Purchasing agent — Mdse. Mgr. — 5 years as operating Engineer Manager over 30 employees—5 years in business for self. 23 years in electrical business. 3 years electrical engineering state university training—1 year Arts and Physics university training. Chief electrician for mines—Mills—and Smelters for years before attending college. Exceptional ability to direct and get along with employees and employees of other departments and help to create high morale, 6 months electrical Inspector on $30,000,000 defense project recently. Present employed by one of largest Ammunition Manufacturing Company in the business as Safety Electrical Engineer designing hundreds of special machinery guards and preventing explosions caused by static. Age 43—Perfect health—210 lbs.—U. S.—Married—no children—Go anywhere for sufficient salary. There is nothing electrical either practical or theoretical within reason applicant can not handle personally or direct. Protestant—white. PW-30, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

WORKS MANAGER, with wide and varied experience in the latest methods of mass-production in electrical and mechanical engineering, used to handle harmoniously a large body of help, strong in rapidly increasing production, now employed. Interested in connections paying $10,000 or more per year. University graduate. PW-31, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

CHIEF POWER PLANT or Maintenance Engineer; 7 years University—B.S., M.E.; 27 years experience; age 50, Vigorous; American, Quaker, 5 years Chief Engineer and Assistant Manager, Electric, ice cold-storage, telephonic Utility company. 13 years mechanical and Electrical Superintendent large steel mill. 7 years Consulting Engineer. Location and conditions prime factors consider any location, west preferable. PW-32, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

FOR SALE

ALL OR PART, 4 Green Stoker Co., used, natural draft stokers for 500 H.P. boilers. Size 11'-5" across links, 11'-6" shaft centers. Laclede Power & Light Co., St. Louis, Mo.

WANTED

(Additional Equipment Wanted Ads on opposite page)

WANTED
GENERATORS

1—AC hor. shaft engine type generator 600 KVA, 60 cy—3 ph—480 volt—180 RPM.
2—AC hor. shaft engine type generators 500 KVA, 60 cy.—3 ph—480 volt—200 RPM.

Holland, Ackerman & Holland
20 North Wacker Drive Chicago, Illinois

What is *your* problem?

Competent men for your staff? . . . employment? . . . or are you looking for—or offering—a business opportunity of special interest to readers of this publication? You can get their attention—at small cost—through an advertisement in the Searchlight Section of Electrical World.